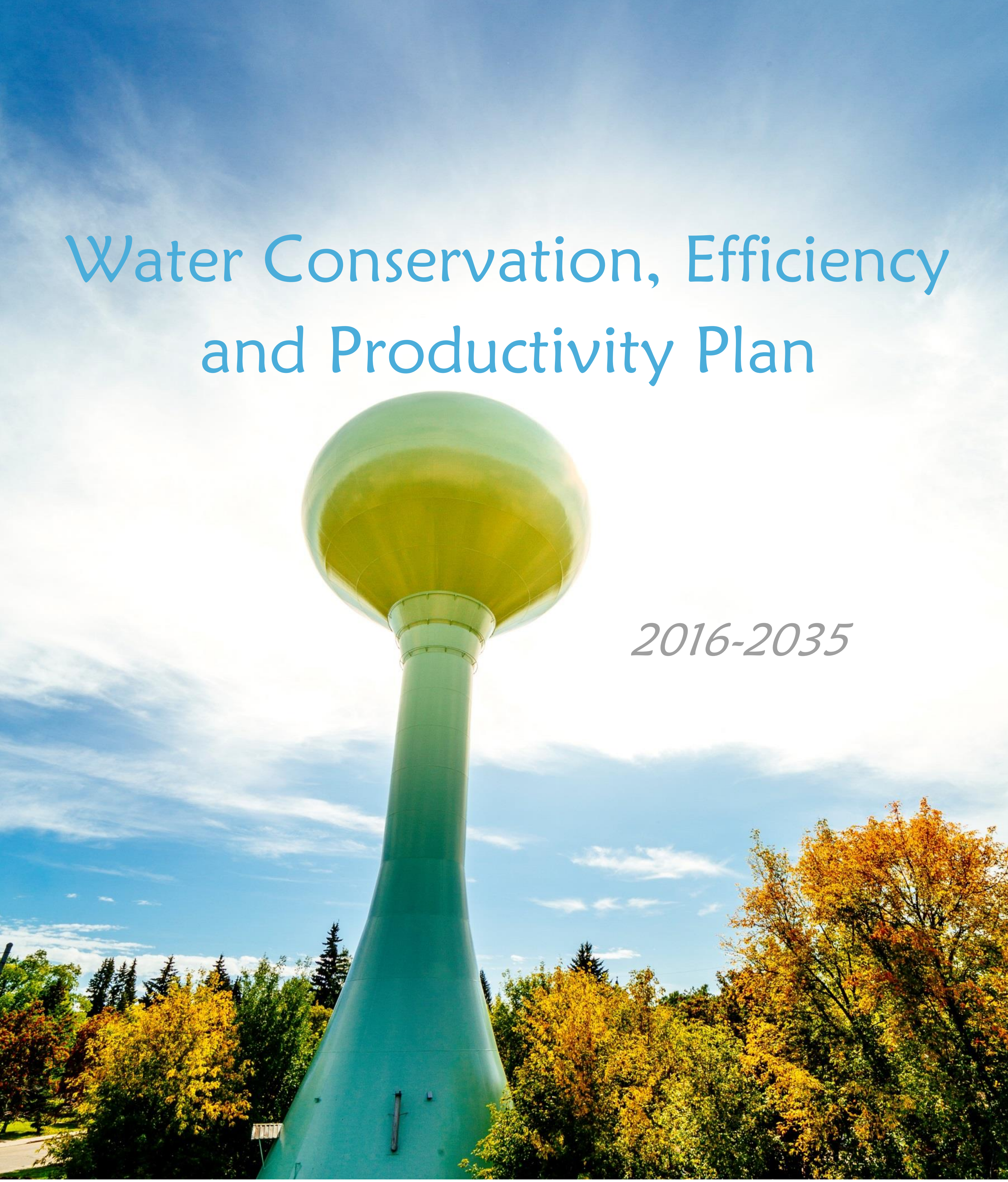
Water Conservation, Efficiency and Productivity Plan



2016-2035

THE CITY OF Red Deer

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"All the water that will ever be, is right now."

– National Geographic, October 1993

EXECUTIVE SUMMARY

Safe drinking water is essential to life. As Red Deer continues to grow, a strong understanding of the current state of this precious resource is critical to ensuring that it is managed responsibly and sustained for the next several decades. The City of Red Deer has sufficient water allocations to serve its short-term needs; however, in light of growing water demands across the region, the Water Conservation, Efficiency and Productivity Plan is a key document that will help secure the future of Red Deer's potable water supply through the proposed water conservation targets and recommended initiatives outlined in the plan.

Increasing water demands from residents and businesses, warmer summers and reduced river flows are just some of the underlying threats to The City's existing drinking water system. The plan aims to ensure that water conservation remains at the forefront of City environmental management by providing a proactive strategy that The City can implement to reduce water waste, improve resource efficiency and reduce impacts of water use on other communities, wildlife and aquatic ecosystems. Environmental, economic, social and cultural considerations were made to identify recommendations for amendments to existing City operational and regulatory tools, as well as educational and outreach initiatives. Clearly defining The City's water conservation priorities and detailing specific program implementation schedules in this plan will increase The City's accountability and provide direction to staff over the next five, ten and twenty years - while supporting the Alberta Urban Municipalities Association and the Government of Alberta's Water For Life Strategy.

The Water Conservation, Efficiency and Productivity Plan is written in ten sections:

1. Introduction and background to water conservation, efficiency and productivity
2. Overview of the Red Deer River Watershed
3. Red Deer's potable water system
4. Red Deer's wastewater system
5. Water quality considerations
6. Water use trends among sectors in Red Deer
7. Existing water conservation, efficiency and productivity tools
8. Future water demand in Red Deer
9. Recommended water conservation targets
10. Recommended water conservation initiatives

Recommended water use targets are revised from the Environmental Master Plan:

*By 2020: a **22% reduction** from 2009 baseline measures (189 litres per capita per day for the residential sector and 105 litres per capita per day for the Industrial, Commercial and Institutional sector), instead of the existing 15% reduction.*

*By 2035: a **30% reduction** from 2009 baseline measures (169 litres per capita per day for the residential sector and 95 litres per capita per day for the Industrial, Commercial and Institutional sector), instead of the existing 25% reduction.*

In addition, water loss reduction targets are:

*By 2020: **maximum of 10%** of total water use should be attributed to losses.*

*By 2035: **maximum of 7%** of total water use should be attributed to losses.*

The plan has been drafted with all Red Deer water users in mind: City residents, regional customers and Industrial, Commercial and Institutional customers, including The City as a corporation. To achieve water conservation, efficiency and productivity, the plan requires support and engagement from all sectors. Fortunately, Red Deer is not presently at a high risk of experiencing short-term water shortages. Yet, it is necessary to work now to implement measures that will help to ensure the long-term sustainability of the water supply. Improving the conservation of our water resources will not be realized overnight; success of the plan will arrive in small, incremental steps, and not without enhanced engagement with our water users and the greater community. It is of the utmost importance that The City ensures that it has a strategy in place for protecting our potable water supply over the next several decades. The plan presents achievable targets and clear strategies that can be implemented over the short, medium and long-term.

1.0 INTRODUCTION

Red Deer is a fast-growing community. Presently, its population is 100,807.[1] At an anticipated medium annual growth rate of 2.23%, Red Deer is expected to grow to 128,409 in the next 10 years and reach 175,726 by 2041.[2] The City has sufficient water allocations to serve its short-term needs; however, in light of growing water demands across the watershed, this plan is a key document that will help to ensure the long-term sustainability of Red Deer's potable water supply.

[1] The City of Red Deer, 2015
[2] The City of Red Deer, 2013

> "Red Deer actively enhances its rich natural environment and minimizes its ecological footprint through City leadership, community collaboration and active stewardship. Red Deer is a leading example of a resilient and sustainable community in which urban and natural systems are effectively integrated to the benefit of both."
>
> - The City of Red Deer Environmental Sustainability Pillar

The purpose of the Water Conservation, Efficiency and Productivity (CEP) Plan is to provide a long-term, achievable and proactive strategy that The City can implement to reduce water waste and improve resource efficiency in Red Deer, including at both the WTP and WWTP systems. The plan focuses on enhancing the delivery and management of Red Deer's potable water supply. Environmental, economic, cultural and social considerations have been made to identify recommendations for amendments to current City operational and regulatory tools, as well as new community initiatives. Targets and strategies in the plan will build on the 2011 Environmental Master Plan (EMP) and will replace the 2007 Water Conservation Strategy.

The City is committed to providing safe, potable water to its users, while assuring the health, safety and future resilience of the surrounding ecosystems and the Red Deer River Watershed. This plan will help provide a clear framework for the sustainable management of our water supply and complement existing City strategies and studies.

1.1 Background

Red Deer residents enjoy a high quality of life, thanks to strong economic growth, employment opportunities, modern recreational facilities and green spaces. Home to over 100,000 residents and situated in the Calgary-Edmonton Corridor in Central Alberta, Red Deer continues to welcome new residents every year. When we reflect on our everyday activities, we quickly realize how vital safe, potable water is to our lives: cooking, taking showers, washing clothes, watering our gardens – the list continues. When we look at the broader picture, the importance of the long-term sustainability of our water supply becomes even more profound: industries rely on large volumes of water for processing the products that we purchase. Some of our favourite recreational activities, including golf and fishing, require water. It is also important that we do not neglect the natural ecosystems and wildlife that co-exist with us and depend on water for survival.

> "From a municipal perspective, **water conservation** refers to the reduction of water used by customers, while **water efficiency** refers to the amount of water being withdrawn from the source to satisfy a specific need. **Productivity** refers to what is done (or produced) with the water by the end-user."
>
> - Alberta Urban Municipalities Association (AUMA)

As our community develops and grows, so does the need to safeguard the resources that are crucial to our growth and the environment that surrounds us.

In Canada, we sometimes believe that our country is afforded with a natural abundance of water. Looking at a map of the world, it does appear that given the sheer number of lakes and oceans surrounding us, we are a leader in global water supply. The truth is that we vastly overestimate the volume of freshwater that is geographically available to us.[3] Moreover, the physical form of water is another important concern:

[3] Bakker, 2007

More than 80 per cent of Alberta's water supply is located in the northern part of the province, but 80 percent of demand comes from the south.

- Government of Canada

Water is considered to be a renewable resource. Through the hydrological cycle, the total supply of water never changes – yet, water is in continuous motion and changes forms, circulating from the atmosphere to the land, to surface water or groundwater, and evaporating back into the atmosphere. While these activities do not exhaust the total supply of water, the *usefulness* of water in its various physical forms is an important distinction, and this impacts the availability of water to us during certain periods. To be useful, water must be in a particular place and of a certain quality[4] required by the user. In our case, useful water means that it is available from the Red Deer River as high quality surface water, to be treated by The City for the delivery of potable water to our customers. However, at certain times, it is possible that our needs may not be met, given the cycling times that depend on the location and use of water. For instance, the level of the Red Deer River is in constant fluctuation, an indication of the changing availability of freshwater. During dry summer spells, the lack of available water in the river becomes especially evident.

[4] Environment Canada, 2012

1.2 Water-Energy Nexus

Our potable water supply system depends heavily on another resource: energy. Water and energy are co-dependent and mutually linked. Natural gas and coal operations require large quantities of water. In turn, energy is relied upon for water services, including water and wastewater treatment, distribution, pumping and heating water in households and facilities – an important consideration for The City. In 2014, the water treatment plant (WTP) and distribution system consumed close to 17,000,000 kilowatt hours (kwh) of energy to treat over 16,000 megalitres (million litres, or ML) of water, and the wastewater treatment plant (WWTP) and pump stations rely on over 15,000,000 kwh of energy to treat 40,000 ML of wastewater – 66% of The City's total annual energy use. At City operations, reducing the amount of water we use minimizes energy use, maximizes efficiency and facilitates the management of energy costs in the water sector. Additionally, reducing energy use helps to reduce greenhouse gas emissions. In 2014, a combined total of energy used for WTP and WWTP operations resulted in approximately 26,880,000 kg of carbon dioxide (CO_2) emitted – the equivalent of over 20,000 round trip flights between Edmonton and London, England.

In short, water conservation is not only beneficial from an ecological, social and cultural standpoint, but it can also cut energy usage, reduce operating costs, improve air quality and help mitigate climate change impacts.

Two-thirds of The City's annual corporate energy use comes from operations at the water and wastewater treatment plants.

1.3 History of Water Conservation, Efficiency and Productivity

In 2009, the Alberta Urban Municipalities Association (AUMA) adopted a CEP Plan for the municipal sector. This plan was developed to support the Government of Alberta's Provincial Water for Life Strategy, which aimed to achieve a 30% improvement in overall water conservation, efficiency and productivity from 2005 levels to 2015 levels from all sectors. The AUMA's CEP Plan identified a set of actions to be implemented by urban municipalities, as well as the following targets:

1. Alberta's urban municipal sector will achieve an average per capita residential water use of 195 litres per capita per day (lpcd) and an average total per capita water use of 341 lpcd by 2020.
    - As of 2013, the average per capita residential water use in Alberta is 169 lpcd, and as of 2014, in Red Deer is 195 lpcd.
    - As of 2013, the average total per capita use in Alberta is 375 lpcd, and as of 2014, in Red Deer is 453 lpcd.
2. Alberta's urban municipal sector will maintain the volume of unaccounted for water (non-revenue water or water losses) at 10% of total water use.
    - As of 2013, the average losses in Alberta are 13%. As of 2014, the average losses in Red Deer are 13%.

The AUMA's CEP Plan aimed to see all Alberta municipalities with populations greater than 10,000 complete their own CEP Plans by the end of 2011. Therefore, in 2011, The City adopted the EMP, which set out residential and Industrial, Commercial and Institutional (ICI) water use targets. These were accepted by the AUMA as CEP targets. In anticipation of early achievement of the 2015 and 2020 EMP water use targets, The City began preliminary research for the development of an updated and comprehensive CEP Plan in 2013.

To date, the EMP and the Water Conservation Strategy have guided us towards achieving water conservation, efficiency and productivity:

> "The **Water Conservation Strategy** is a long-term, proactive plan that outlines several initiatives The City can implement to reduce water waste and improve water efficiency. The strategy targets municipal, residential, commercial, institutional and industrial users of municipally treated water."
>
> - Water Conservation Strategy, 2007

The Water Conservation Strategy was created to develop strategies for ensuring the long-term security of The City's future water supply, taking into consideration population and economic growth, future competition across sectors, and resource efficiency at the WTP and WWTP. The development of the strategy relied on extensive participation and collaboration by stakeholder groups, including City staff, external partners and members of the public.

Since the development of the strategy, a number of its recommendations have been successfully implemented, including: water audits at City facilities, a water saver kit giveaway to the public, a naturescaping contest, an amendment to the utility bylaw to require water efficient toilets in new dwellings, water efficient toilet rebates, rain barrel sales and a revision of the water and wastewater utility rates to be more reflective of use rates for users. Yet, the strategy did not include achievable and measurable targets to guide City planning.

"The intent of the **Environmental Master Plan** is to provide The City and the people of Red Deer with a road map to improved environmental performance. To achieve this, the Plan includes clear goals and measureable environmental targets, as well as recommendations for actions for both The City of Red Deer as a corporation and for the greater community."

- Environmental Master Plan, 2011

The EMP presents a framework for achieving environmental sustainability in The City over the next twenty years. The EMP provides detailed recommendations for actions and measurable targets under seven focus areas: water, ecology, transportation, built environment, air, energy and waste. Under the water focus area, the EMP outlines a target of reducing per capita daily water use from 2009 baseline levels by 8% by 2015, 15% by 2020, and 25% by 2035.

To date, the 2015 and 2020 targets have been surpassed. The EMP highlights specific actions for consideration; for example, rainwater capture for irrigation, low-flow fixture incentives and wastewater effluent re-use for irrigation at the River Bend Golf Course. The EMP also outlines the need to improve the quality of Red Deer's rivers, creeks and water bodies.

While the EMP is an important and useful document, a separate plan is needed to more comprehensively focus on water conservation measures. The CEP Plan, like the Waste Management Master Plan and the Corporate Greenhouse Gas Emissions Inventory, serves as an extension of the EMP, builds on and revises the EMP targets, and replaces the Water Conservation Strategy. The CEP Plan was developed with all Red Deer water users in mind. These include residents, regional customers and ICI customers (including The City as a corporation). To achieve water conservation, efficiency and productivity, the plan requires support and engagement from all user groups.

Minimizing water demand and maximizing resource efficiency will help The City to address long-term threats to our water system. Below are key facts to consider:

- **At an anticipated medium annual growth rate of 2.23%, Red Deer's current population is expected to nearly double by 2041**.[4] The City will be expected to provide a greater supply than its current potable water use, adding pressure to the water and wastewater systems. The City currently uses approximately 60% of its total annual allocation from the Red Deer River.
- The key industries in Red Deer are manufacturing, oil and gas, construction, health care, professional services and retail. **By 2021, these industries are expected to create over 9,800 jobs.**[5] Approximately 26% of potable water produced annually is used by the ICI sector. The

[5] The City of RED Deer, 2015

volume of water used by the ICI sector should be expected to increase as this customer base grows.

- **Climate change projections for Red Deer show expected annual temperature increases of 1.0°C by 2020, 2.2°C by 2050, and 3.8°C by 2080**, which has implications for increased evapotranspiration rates and reduced stream flows. The number of hot days, greater than 30°C, is expected to increase. The Red Deer River at Blindman at the mouth is expected to see a 13% decrease in stream flows during the summer months by 2050.[6]
- **Stormwater is not treated in The City** and is discharged directly into the Red Deer River. The addition of nutrient loads impacts the quality of water entering the WTP system, and therefore, the strain on the system. The greater the nutrient load, the greater the energy and resources required to operate the system to treat the water.
- The Red Deer River and local water bodies play an **important social and cultural role**, and are valued by residents who fish, canoe and partake in other water-based recreational activities.
- Other threats to the Red Deer River include the over-exploitation of water sources, pollution of waters, degradation of natural ecosystems and invasions of non-native species – including **zebra and quagga mussels** as alerted by the Government of Alberta.

While the CEP Plan focuses principally on managing Red Deer's potable water supply, there are a number of related environmental strategies as well as studies currently in development by The City. These studies address the greater scope of watershed management and complement the CEP Plan. Together, these plans help us to better manage the health of the Red Deer River Watershed. They include:

- **2013 Drinking Water Safety Plan (DWSP)**. The DWSP aims to ensure that the quality of water delivered to customers is of safe and consistent quality. It defines actions that have been or are expected to be completed within the next few years related to source, treatment, network and customer risks.
- **2014 Red Deer Water Quality Assessment**. The assessment reviews the impacts of point and non-point source pollution on water quality in creeks and rivers, and provides recommendations for the effective management of the various pollution sources.
- **2015 Storm Drainage Master Plan**. The plan recommends strategies for optimizing the operation and maintenance of stormwater infrastructure throughout the city.
- **Integrated Rain Water Management Plan** (in progress). This plan will identify opportunities to implement integrated solutions for stormwater management in Red Deer, including Low Impact Development practices.

[6] ICLEI Canada, 2011

1.4 Who Benefits from the CEP Plan?

All Customers

- ✓ *Improves customers' control over their utility bill*
- ✓ *Improves quality of treated water for customers*
- ✓ *Ensures the security of Red Deer's water supply for future generations and customers*

Community Well-Being

- ✓ *Enhances the reliability, flexibility and sustainability of the supply system in times of floods or droughts*
- ✓ *Ensures the long-term availability of water for recreational activities*
- ✓ *Promotes community awareness of water conservation*

City of Red Deer Utilities

- ✓ *Reduces current and future constraints on the capacity of the water supply system*
- ✓ *Reduces energy use at the treatment plants and the distribution system*
- ✓ *Reduces water and wastewater treatment costs*
- ✓ *Delays the need for and cost of purchasing a new allocation licence or finding a new water source*
- ✓ *Improves water quality by improving the effectiveness of the WTP*

Downstream Users of the Red Deer River

- ✓ *Adequate water flows are maintained for users between Red Deer and towards the Saskatchewan border*
- ✓ *Helps the province meet its flow requirements under the Master Agreement of Apportionment*

Environmental Sustainability

- ✓ *Reduces energy use and the carbon footprint of Red Deer*
- ✓ *Reduces impacts on aquatic ecosystem health and the Red Deer River Watershed*

1.5 Existing Challenges to Water Conservation

The CEP Plan addresses a number of threats and weaknesses to the existing system. The Strengths, Weaknesses, Opportunities and Threats (SWOT) analyses for the water system, wastewater system, utilities, regulatory tools and community are presented below.

Table 1. SWOT Analysis of the Water System

	Water System (operational, infrastructure, quality, quantity)
Strengths	• Waterworks monitoring and leak detection system is up to date and current with other municipalities. • WTP is currently undergoing maintenance and operational upgrades. • 2015 and 2020 residential and ICI per capita daily water use targets set forth in the EMP have been surpassed.
Weaknesses	• Population and economic growth in the area served will drive total water demand, putting more stress on the system. • Challenge managing peak demand during droughts and low rainfall periods. • Large volumes of potable water are used for non-potable water uses in facilities and outdoor operations. • Aging infrastructure is increasing maintenance demands.
Opportunities	• Implementation of measures to meet the long-term water conservation targets set forth in the EMP. • Use of Automatic Meter Reading will improve system efficiency. • Pressure management systems may help to reduce leaks and better control flow.
Threats	• Aging infrastructure threatens the system, including valve failures and line breaks. • Climate change impacts (e.g. changes in stream flow, increased drought, increased floods and changes in seasonal temperatures) threaten demands for water.

Table 2. SWOT Analysis of the Wastewater System

	Wastewater System (operational, infrastructure, quality, quantity)
Strengths	• WWTP is currently undergoing maintenance and operational updates. • Effluent is re-used within the WWTP operations. • Storm Utility Feasibility Study is underway with considerations of stormwater conservation credits.
Weaknesses	• Effluent water temperatures put aquatic habitats and water quality at risk.
Opportunities	• Use of effluent for other non-potable water uses. • Use of stormwater and greywater for non-potable water uses. • Enhance aquatic habitats through reducing effluent temperatures and increasing water volumes downstream of the WWTP.
Threats	• Stormwater run-off concerns with contaminants entering into our creeks and rivers with minimal treatment. • Potential adverse effect of water conservation in certain neighbourhoods where infrastructure is older and prone to backups when flow is low.

Table 3. SWOT Analysis of Utilities

Utilities (budget, rate structure, capital)	
Strengths	• Utility is owned and operated by The City, and does not contract services out. • Full-cost accounting, volume-based rate structure helps ensure customers make conscious decisions about their water usage and understand the implications of usage to the charges on their utility bills, helping to reduce water use. • Household water usage is more accurately reflected. • Utility rates are competitive with other municipalities in Alberta. • All customers are metered.
Weaknesses	• Peak and seasonal demands are not addressed through the existing rate structure.
Opportunities	• Wastewater revenue will increase due to the regional line treatment (increase in large customer base). • Meter operational use (hydrant flushing, etc).
Threats	• Full-cost accounting rate structure puts at risk potential revenue due to potential lower use. • Provincial and federal budgets may have an impact at the municipal level.

Table 4. SWOT Analysis of the Regulatory Tools

Regulatory Tools (bylaws, policies, government legislation, laws)	
Strengths	• Meet and exceed all current provincial regulatory utility requirements and guidelines. • Several City bylaws, plans, standards, and policies include water conservation measures as requirements. • Corporate water conservation policy of standards for City facilities.
Weaknesses	• Lack of strict regulations on outdoor watering during low rainfall periods or daytime hours. • Little guidance from the provincial or federal governments on water efficiency strategies.
Opportunities	• Water rationing policy is currently being developed that will include outdoor watering restrictions during low seasonal rainfall periods.
Threats	• Increasing demands from other regions of Alberta for allocations from the Red Deer River may impact future allocations required by The City.

Table 5. SWOT Analysis of the Community

Community (public awareness, education, values, engagement)	
Strengths	• Diverse range of initiatives through the Healthy Yards Program over the years: rain barrel rebates, naturescaping contest, water saver kit giveaway. • Strong participation in the Toilet Rebate Program since 2008. • Annual celebration of World Water Day. • Willing and engaged partnerships with external organizations, including the Red Deer River Watershed Alliance and the Waskasoo Environmental Education Society. • Ongoing outreach with children through class presentations by the Environmental Educator. • The concept of water conservation has a strong presence in the community already and community members feel as if they have a certain level of control over their water usage (as compared to managing air quality and greenhouse gas emissions, which are difficult to visualize).
Weaknesses	• Limited staff capacity to carry out corporate or public initiatives (including limited

	capacity to work directly with homeowners on water conservation initiatives, such as providing advice on how to use the water saver kits). • Limited outreach with ICI customers. • Lack of understanding by customers and the community about the water system, along with the importance of water conservation. • The level of engagement in water conservation may be weather-driven; people are more likely to participate if water scarcity is a present issue.
Opportunities	• Promote water use audits to ICI businesses and provide a standard set of best practices to implement in facilities in Red Deer. • Expand Toilet Rebate Program to rebates for other appliances. • Increase public communication and engagement through the website. • Continue WTP and WWTP tours once upgrades are completed. • Hire seasonal water conservation staff to engage and educate the public.
Threats	• Myth of water abundance makes it challenging to initiate conservation action by members of the public. • Green (irrigated) lawns are valued by most homeowners over water conservation. • ICI users may lack motivation or interest in carrying out water audits or implementing water conservation measures. • Residents and tourists are drawn to both natural and man-made water sources during the summer months. Spray parks, pools, misters and drinking fountains are in high demand by residents and all require significant water allocations. More of these amenities will likely be added in the future. • Climate change is significantly decreasing soil moisture levels, so irrigation systems will likely have to be added on sports fields, as well as increased watering of trees, shrub beds and flower beds.

2.0 LOOKING AT THE BIGGER PICTURE:

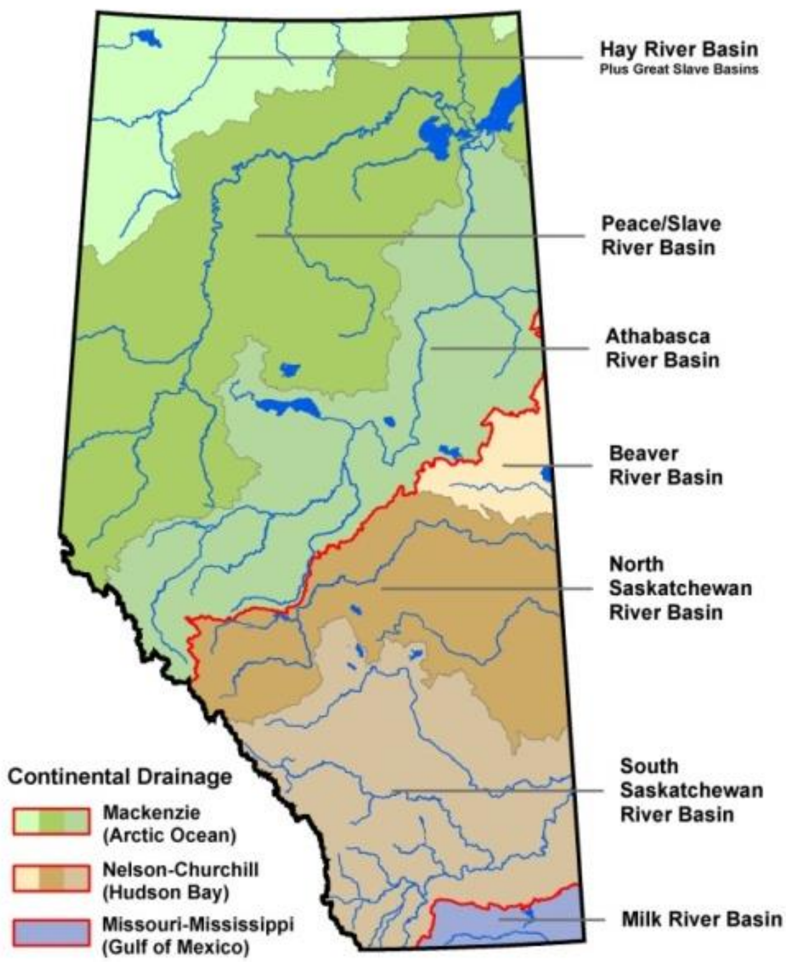
THE RED DEER RIVER WATERSHED

Our environmental responsibility does not end at city boundaries, but continues throughout the entire Red Deer Watershed. Many municipalities downstream of Red Deer also rely on the Red Deer River for their water supply, and it is up to us to ensure that we are responsible stewards when sharing this precious resource.

Together with the Oldman River, Bow River and South Saskatchewan River, the Red Deer River forms the South Saskatchewan River Basin (SSRB). The basin covers an area of 121,095 km^2, of which 41% is the Red Deer sub-basin, 22% the Oldman, 21% the Bow and 16% the South Saskatchewan.[7]

[7] Alberta ESRD, 2014

Figure 1. Major Basins in Alberta[8]



20% of the world's drinking water supply is in Canada, but Alberta accounts for just **2.2%** of this amount.

The Red Deer River originates in the Rocky Mountains in Banff National Park and is fed primarily by snowmelt, precipitation and some glacial runoff. The headwaters flow across southern Alberta for a total of 724 km. Jurisdictional termination occurs once the river flows 8 km across the Alberta/Saskatchewan border where it joins up with the South Saskatchewan River, which drains into Lake Winnipeg in Manitoba, and eventually, the Hudson Bay.[9] The Dickson Reservoir, named Gleniffer Lake, is located on the Red Deer River, approximately 26 km west of Innisfail. The reservoir was created to meet minimum flows in the Red Deer River during the winter and assist in meeting the Master Agreement. Its secondary purpose includes flood control, recreational opportunities at the lake and power generation. The Dickson Dam helps provide a reliable drinking water supply to City customers, especially in the low-flow winter months.

[8] Alberta ESRD, 2014
[9] Red Deer River Watershed Alliance, 2009

The Master Agreement on Apportionment governs the sharing of waters of eastwards flowing inter-provincial streams between Alberta and Saskatchewan. The City, along with other SSRB users, is responsible for ensuring that half of the SSRB's total water supply is allocated to Saskatchewan. While water allocations limits have already been reached or exceeded in the Bow, Oldman and South Saskatchewan River sub-basins, the Red Deer River is the only sub-basin of the SSRB that is open to new surface water licences. As a result, the river is under pressure of increasing demands from the south as well as from the northeast. Currently, allocations from the Red Deer River are approximately 335,000 dam^3, or 61% of the temporary limit of 550,000 dam^3. The City uses 5% of the Red Deer River's temporary allocation limit.

In 1905, The City was issued one water allocation licence to divert water from the Red Deer River. Since then, The City has received three more allocations, and has a total of 27,428 ML of water allocated per year. The City currently withdraws approximately 60% of its total annual allocation. In 2014, 88% of water withdrawn from the river was returned as treated wastewater effluent.

Minimizing the volume of water withdrawn from the Red Deer River is important for maintaining adequate river flows, preserving aquatic habitats and ecosystems, and securing the long-term supply for the entire Red Deer River Watershed and its users.

In 2014, 88% of water withdrawn from the Red Deer River was returned to the river as treated wastewater effluent.

3.0 POTABLE WATER SYSTEM

The City treats and supplies its own potable water. It also treats water for its regional customers: Red Deer County and the North Red Deer River Water Services Commission (NRDRWSC), which is comprised of The City of Lacombe, Lacombe County, Town of Blackfalds, Town of Ponoka and Ponoka County. These municipalities have obtained their own allocation licenses (total 13,391 ML water per year), which The City withdraws at the WTP on their behalf. Water supply is billed back to them on a cost-recovery basis. In August 2015, City Council approved a request from the Town of Sylvan Lake to build a transmission line which would allow The City to treat and supply water to Sylvan Lake.

In 2014, The City supplied 7,011 ML water to nearly 98,585 City of Red Deer residents, 4,034 ML to over 1,700 ICI customers and 3,079 ML to over 25,000 regional customers. Accounting for losses, a total of 16,303 ML was used.

3.1 Water Treatment and Distribution

Table 6. City of Red Deer Water System Data, 2014

City of Red Deer Water System Data (2014)	
Population Served	125,944
Annual Allocation	27,528 ML/year
Annual Water Production (Treated)	16,353 ML/year
Rated (Installed) Capacity	102 ML/day
Average Day Demand	45 ML
Maximum Day Demand	68 ML
Maximum Day Per Capita Demand	540 lpcd

Raw surface water from the Red Deer River enters the WTP through low lift pumps. Since the river is at a lower level than the WTP, the pumps facilitate the upwards movement of water into the WTP. Once treated, potable water leaves the plant through high lift pumps and enters the distribution system through a 589 km network of pipes to 5 storage reservoirs (combined capacity of 39 ML), 6 pump stations, 4 pressure zones and 2,324 hydrants. There are 31,095 service connections in total. The WTP, which serves a total population of 125,944, has a rated capacity of 102 ML/day. It treats an average of 45 ML/day.

Water meters are used for all City operations, where practical, as well as for all residential and ICI customers. Water is metered at the low lift pumps into the WTP, at the high lift pumps exiting the WTP, and at each customer. The information provided at each meter helps to give an estimation of water use at the WTP and water losses during distribution to customers.

The WTP is currently undergoing a series of upgrades, including:

- *Upgrades to various chemical feed systems, including sodium hypochlorite, potassium permanganate and powdered activated carbon (PAC)*
- *Upgrades to building heat, ventilation, air conditioning (HVAC) and boiler systems*
- *Replacement of the backwash pump*
- *Upgrades to one high lift pump, including a new variable frequency drive (VFD)*
- *Upgrades to the control system wiring and supervisory control and data acquisition (SCADA) system*
- *Installation of a new de-chlorination system*
- *Upgrades to the current standby power system*
- *Rated capacity will increase to 120 ML/day*

4.0 WASTEWATER SYSTEM

The City's WWTP is a Class IV plant that treats wastewater from The City of Red Deer, the Town of Penhold, the Hamlet of Springbrook and Red Deer County (Gasoline Alley) through the existing Waskasoo Regional Wastewater Line. Wastewater from the Towns of Olds and Innisfail is treated through the South Leg Regional Wastewater Pipeline. Presently, the WWTP process design capacity is 47.5 ML/day.

Table 7. City of Red Deer Wastewater System Data, 2014

City of Red Deer Wastewater System Data (2014)	
Population Served	98,585
Annual Wastewater Supply Capacity	17,338 ML
Annual Wastewater Production (Treated)	14,845 ML
Average Day Demand	40.65 ML
Maximum Day Demand	57.05 ML
Maximum Daily Supply Capacity	47.5 ML

The WWTP relies on gravity to move the wastewater to the plant. Once wastewater reaches the plant, it is pumped into the headworks (initial stages of treatment) by lift stations. Treated effluent flows back to the river through gravity. In an effort to conserve water, the WWTP re-uses effluent for WWTP operations. Approximately 88% of water withdrawn from the river is discharged back as effluent. There exist 73 stormwater management facilities: 52 dry storm ponds, 12 wet ponds and 9 wetlands.

The WWTP is currently undergoing a series of upgrades, including:

- *Two new primary clarifiers, a new bioreactor, three new secondary clarifiers and a new sludge pump house and blower building for liquid stream treatment*
- *The secondary digester for solid stream treatment will be converted to a primary digester*
- *A new dissolved air flotation unit and new fermenter*
- *Excess digester gas will be used to generate power and heat for use in the plant*
- *Design capacity will increase to 72 ML/day*

5.0 WATER QUALITY IN THE RIVER

The efficiency of the WTP system is heavily dependent on the quality of water in the Red Deer River. It is important to note that stormwater is not currently treated and is discharged directly into the river; water use, land use and human activities in the Red Deer River Watershed all have a significant impact on the quality of water entering our treatment plants as well as downstream users of the river. The high variability of nutrients, solids, oocytes, viruses and other materials in the raw water require greater resources and capabilities of the WTP to ensure that water is adequately treated for human use. Activities that contribute to stormwater contamination include lawn irrigation and fertilization, vehicle washing, improper hazardous waste disposal and other outdoor water use activities. In being aware and knowledgeable of the impacts of our activities on the river and by conserving water, we reduce the amount of resources required for the proper treatment of our water – thereby leading to cost savings for our operations.

6.0 WATER USE IN RED DEER

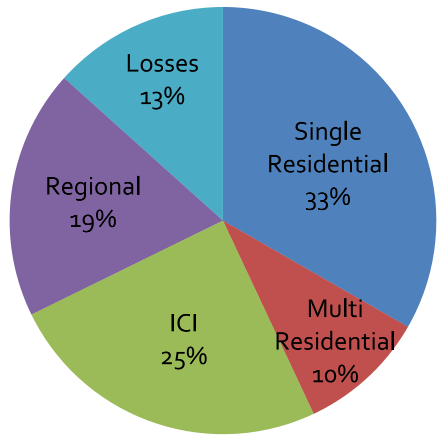
6.1 Red Deer's Water Use

Understanding Red Deer's water user groups and use trends is necessary for developing realistic and achievable targets. Though Red Deer's population and total annual use continue to increase, residential per capita use has been on a decline since 2009. This reduction reflects the success of recent changes to The City's operational, regulatory and financial tools, as well as improved engagement among user groups.

6.2 Sectoral Water Use

In Red Deer, 43% of potable water is used by residents, 25% is used by ICI customers (including The City) and 19% is used by regional customers.

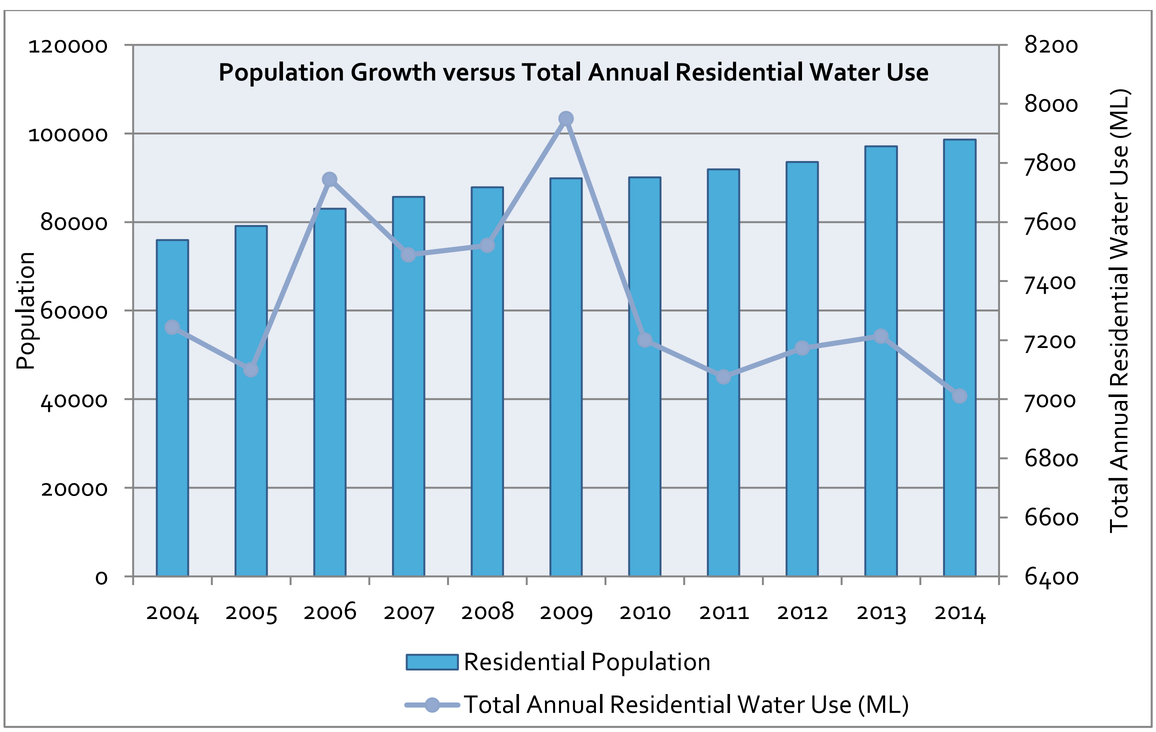
Figure 2. Water use by sector in Red Deer, 2014



6.3 Residential Water Use

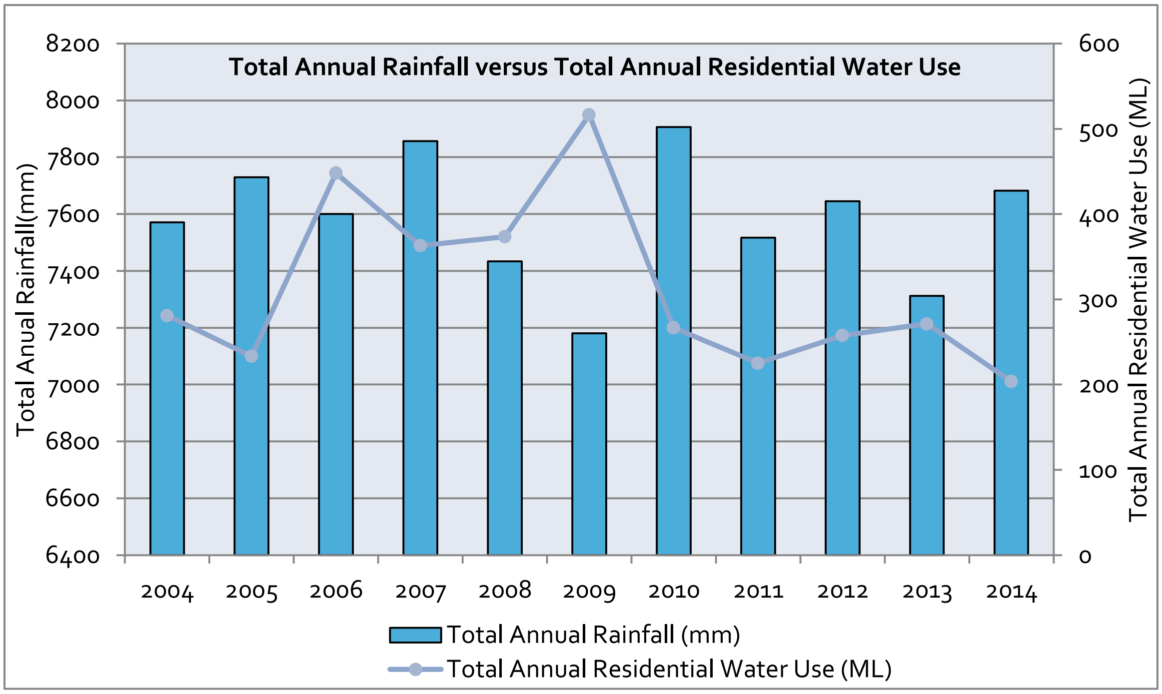
Between 2004 and 2009, Red Deer saw a gradual increase in total annual water use. It is interesting to note that water use increased by 5.7% between 2008 and 2009, followed by a 10% reduction between 2009 and 2010.

Figure 3. Population Growth Versus Total Annual Residential Water Use in Red Deer



In 2009, there was a significant reduction in total rainfall for the year, which can be observed in Figure 4. It is possible that the increase in water use during 2009 can be attributed to an increase in water use for outdoor irrigation.

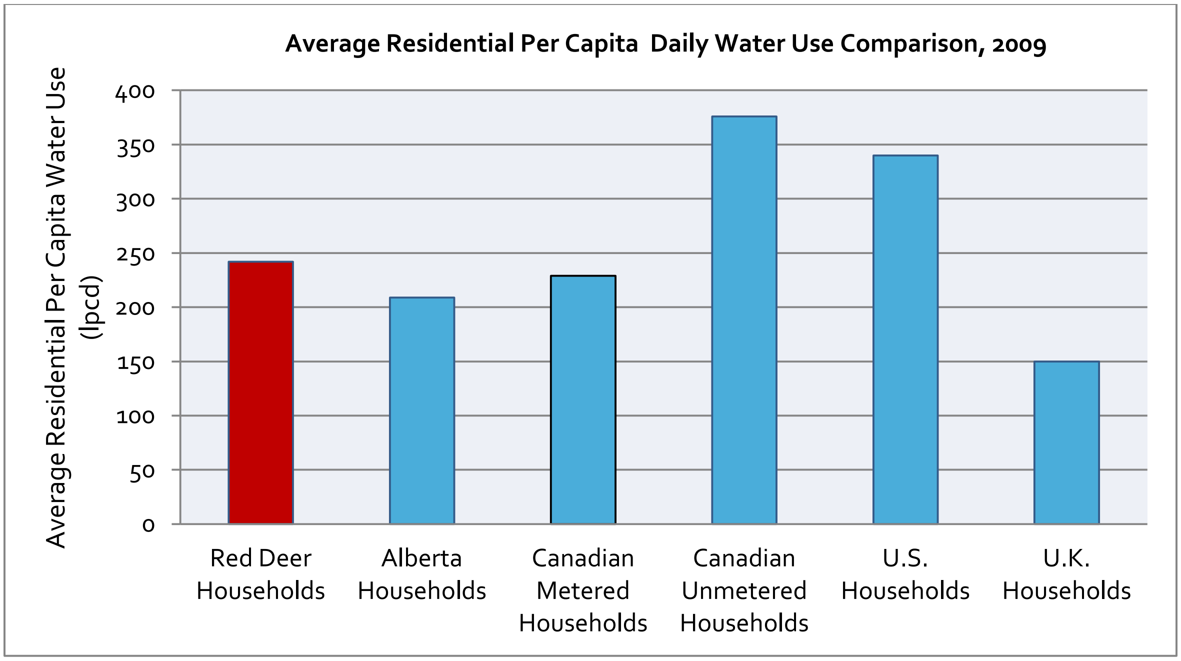
Figure 4. Total Annual Rainfall Versus Total Annual Residential Water Use in Red Deer



As of 2009, 72% of single-family Canadian residences are metered, while 87% of commercial businesses are metered.[10] In Red Deer, all City customers are metered. As shown in Figure 5, water use differs drastically when comparing customers whose households are unmetered and are charged fixed rates to customers whose households are metered and are charged variable rates. In 2009, the average residential per capita daily water use in Canada was 375 lpcd for customers with fixed rates, 65% greater than customers with volumetric rates (229 lpcd).[11] In other parts of the world, particularly Europe, water use can be considerably lower – for example, in the U.K., water use is at just 150 lpcd.[12] Lower use rates in some European countries may be attributed to higher utility fees, more efficient infrastructure and systems, stricter regulatory tools and increased public awareness and engagement.[13]

[10] Environment Canada, 2011
[11] Environment Canada, 2011
[12] Waterwise, 2012
[13] Environment Canada, 2013

Figure 5. Average Residential Per Capita Daily Water Use in Canada, 2009



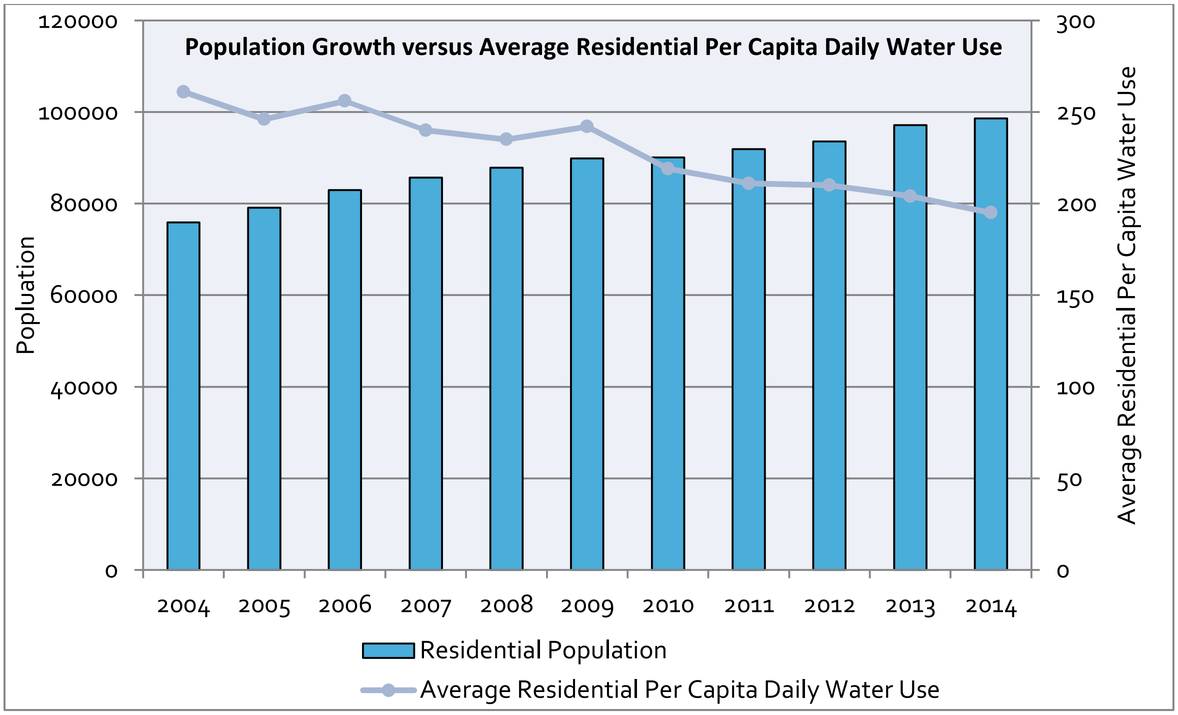
It is important bear in mind that the above data is over five years old. Since the EMP was developed in 2011 with water conservation targets, Red Deer's residential per capita daily water use has decreased by 19%, and indicated in Table 8.

Table 8. Historical Residential Per Capita Daily Water Use in Red Deer

Year	Average Residential Per Capita Daily Water Use (lpcd)
2004	261
2005	246
2006	256
2007	240
2008	235
2009	242
2010	219
2011	211
2012	210
2013	204
2014	195

Despite Red Deer's population increasing, residential per capita daily water use has been decreasing since 2009. Knowing this keeps us optimistic that despite the continual growth of our city, conservation measures are helping us to ensure that Red Deer's water needs will be met over the long-term.

Figure 6. Population Growth Versus Average Residential Per Capita Daily Water Use in Red Deer



6.4 ICI Water Use

Since 2011, per capita daily water use by ICI customers has decreased by 5%.

Table 9. Historical ICI Per Capita Daily Water Use in Red Deer

Year	Average ICI Per Capita Daily Water Use (lpcd)
2004	159
2005	161
2006	159
2007	149
2008	145
2009	134
2010	127
2011	122
2012	120
2013	118
2014	112

6.5 Seasonal Water Use

The water supply is typically at risk of being limited during the warmer months, as higher temperatures threaten Red Deer with the possibility of low stream flow and drought events. At the same time, water use normally increases in the summer when Red Deerians partake in outdoor activities that require greater volumes of water, such as lawn irrigation, gardening and golf. In 2014, average seasonal per capita daily water use (May to September) for residents was 212 lpcd, as compared to the average annual per capita daily water use of 195 lpcd. ICI seasonal per capita daily water use was 122 lpcd, as compared to the average annual per capita daily water use of 112 lpcd. These increases in seasonal use from both sectors are an indication that strategies that address summer and outdoor water use should be introduced.

Figure 7. Seasonal Residential Per Capita Water Use in Red Deer

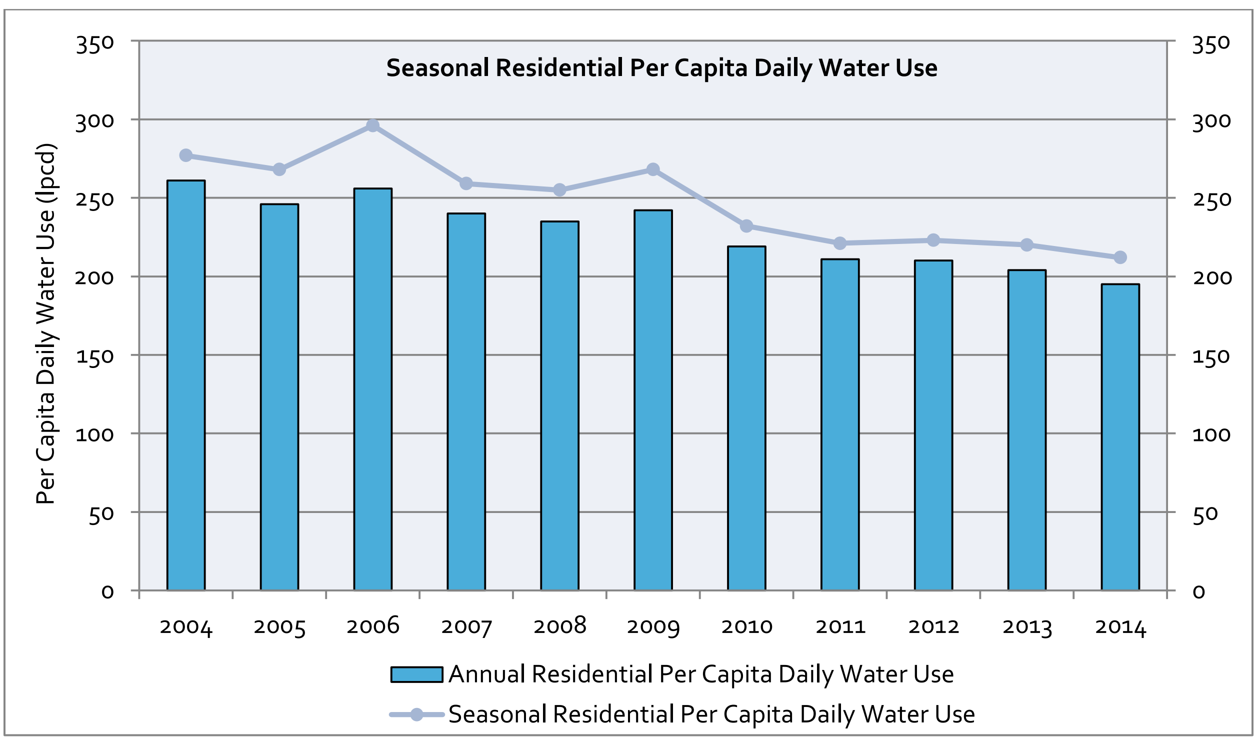
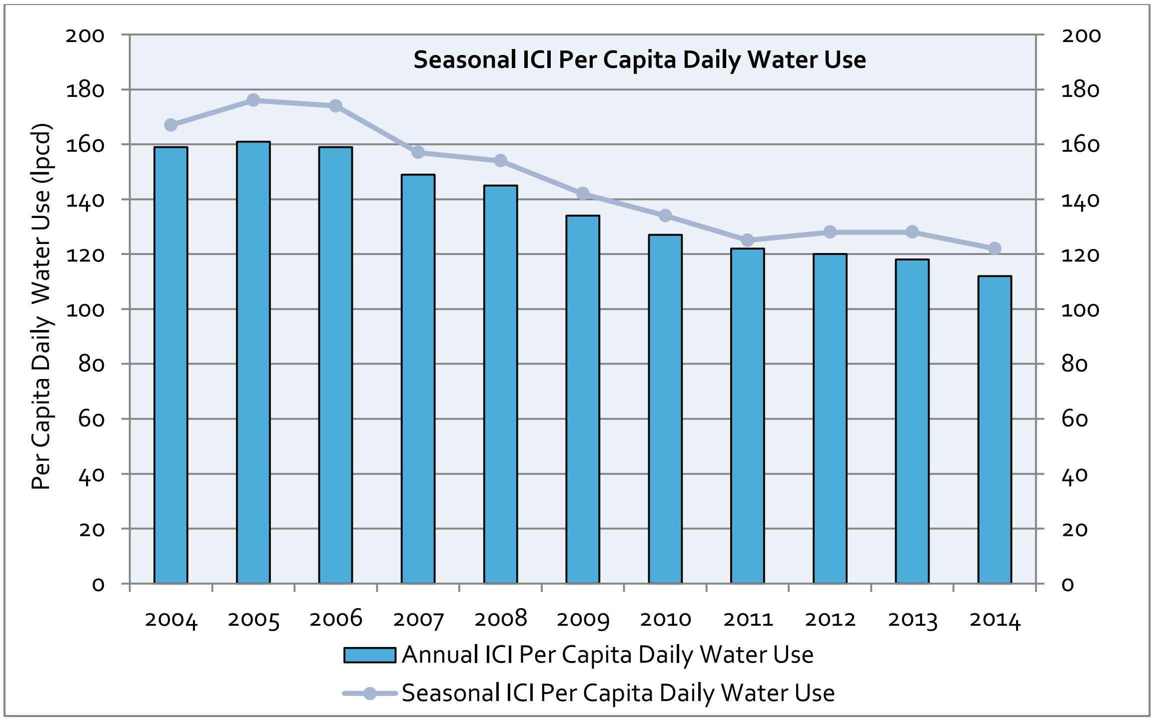


Figure 8. Seasonal ICI Per Capita Water Use in Red Deer



6.6 Total Annual Maximum Day Demand

Maximum day demand in 2014 was 68 ML/day, 51% greater than the average day demand. Maximum per capita day demand was 540 lpcd.

In 2014, Red Deer customers used 16,303 megalitres of water – enough to fill up over **6,000** Olympic-sized swimming pools.

6.7 Water Losses and Non-Revenue Water

Water use in Red Deer can be broken down into two categories: revenue water and non-revenue water. Revenue water includes all billed and metered water: customers, City facilities, irrigation and some hydrants. Non-revenue (also known as "unaccounted water" or "water losses") water includes all other water: unmetered water that is used for City operations, as well as metering inaccuracies, data handling errors and real, physical water losses - such as thefts, pipe leakages and water main breaks.

Table 10. Revenue and Non-Revenue Water in Red Deer

Revenue		Non-Revenue	
Metered	**Un-Metered**	**Metered**	**Un-Metered**
Residential customers	None	Sewer cleaning	Meter bypasses
Municipal facilities			Chlorine analyzer
ICI businesses			Water theft/unauthorized use
Regional (bulk water) customers			Un-directional flushing
Irrigation (seasonal)			Municipal operations: Collections, Parks, Roads, water truck loads, contractor loads, commissioning
Hydrants			Leakages on transmission and distribution mains
			Leakages at storage tanks
			Leakages on service connections
			Fire hydrants
			Water main breaks
			Meter inaccuracies
			Data handling errors

According to Environment Canada, approximately 13% of water was lost from distribution systems before reaching Canadian customers in 2009. In 2014, non-revenue water in Red Deer accounted for approximately 13% of total water use. Reducing our water losses is a priority in this plan. Three key areas include:

1. Leakages
2. Thefts
3. Unmetered water in municipal and contractor operations

The initiatives outlined in this plan will help to address and minimize these water losses.

7.0 WATER CONSERVATION, EFFICIENCY AND PRODUCTIVITY TOOLS

The City employs a range of preventative maintenance, financial and regulatory tools that help sustainably manage Red Deer's water supply. As well, a series of corporate leadership, conservation and educational awareness initiatives have been undertaken over the years to improve conservation and resource efficiency in Red Deer.

7.1 Operational Tools

The City carries out a number of preventative maintenance tools for water utilities:

- Tracking losses from water breaks, hydrant flushing and hydrant meters for contractors and fire halls.
- To prevent the corrosion of the metal surfaces of water mains, cathodic protection is applied to the mains.
- Cast iron (which is more susceptible to corrosion) potable water transmission lines are replaced with polyvinyl chloride (PVC) water mains.
- Video inspection, called Closed Circuit Television (CCTV), is employed to inspect most sewer mains as needed.
- The wastewater lab is accredited to a set of environmental management standards, called ISO 17025, which helps minimize the impact of operations on environmental sustainability.
- Replacements of old fire hydrants.
- Relining of water and sewer mains.

A number of initiatives are being introduced that will help The City to monitor and reduce water use.

- The City is beginning to introduce an Automated Meter Reading (AMR) system, an advanced communications technology that allows meters to be read remotely. This will eventually transition into Advanced Metering Infrastructure (AMI) technology which allows for the two-way communication between the customer and Water Utilities.
- The current leak detection system relies on visual indicators. An advanced acoustic leak detection system, ZoneScan 820 radio logger, has been tested in some locations. Program design is ongoing.
- A review of water main flushing practices for new subdivision developments is ongoing. Because water mains are sized for the ultimate expansion of developments, until expansion is reached extra flushing is required to maintain water quality.
- The City is beginning to phase in the requirement of meters on all City and contractor vehicles. In the next three to four years, City departments will be charged for water use.

7.2 Financial Tools

The City employs a full-cost accounting, volume-based pricing system to all customers. In addition to a fixed rate, a usage (variable) rate is added to the structure. This gives customers more control over their utility bills as customers are charged based on the volume of water that they use. With the goal of placing greater emphasis on usage charges than fixed charges, the structure places the onus on individuals to be responsible with their levels of water use and provides an incentive to conserve potable water.[14]

The Utility Policy, created in 2012, states the following on rate structuring[15]:

Rate structures must balance the following principles:

a) *Consumer rates should reflect usage and promote conservation*
b) *Consumer rates should be structured so that revenue requirements can be met within a reasonable tolerance.*

Rates will be:

a) *Fair and equitable, ensuring customers are contributing equitably in proportion to the cost of the system;*
b) *Defensible, able to demonstrate that data is available to support the assumption used in the rate; and the assumption follows the industry acceptable practices;*
c) *Clear, understandable and logical*

Rate making will:

a) *Adhere to regulated and/or legislated requirements;*
b) *Adhere to generally accepted rate making standards*

Effective March 1, 2015, the Utility Bylaw (based on the Utility Policy), was amended to continue The City's transition to a water rate structure that is more reflective of water use rates for residential, commercial and regional customers. The changes represent an overall 2% increase from 2014 rates. Utility rates will continue to be amended over the next two years.

[14] The City of Red Deer, 2012

Table 11. 2015 Residential Water Rate Changes

Residential Water Rate Changes				
	March 2012	**March 2013**	**March 2014**	**March 2015**
Usage Fee per m^3	$0.81	$1.01	$1.12	**$1.30**
Fixed Monthly Fee (16 mm meter)	$21.36	$19.65	$19.30	**$17.20**
Typical Bill Monthly (based on $17m^3$/household)	$35.13	$36.82	$38.34	**$39.30**
Increase over prior year for typical usage (17 m^3)	9.0%	4.8%	4.1%	**2.5%**

Water rates, new for bulk users, are $2.00 per m^3, while rates for regional customers have increased by about 3% over the 2014 rates:

Red Deer County	*$1.26*
North Red Deer River Water Services Commission	*$1.25*

The dollars required to be raised from rates to cover the revenue of operating the water utility range depend on the water meter size. For the smallest water meter at 16 mm, revenue is recovered 55% from the usage rate and 45% from the fixed rate.

7.3 Regulatory Tools

Water conservation, efficiency and productivity considerations are incorporated in several City-wide bylaws, policies, plans and standards.

Table 12. City of Red Deer Land Use Bylaw

Land Use Bylaw[15]	
Part 3 General Regulations Applicable to All Districts	
3.6 Landscaping Regulations	(3) The landscape design shall include details, specifying the mixture of coniferous and deciduous trees and shrubs designed to provide landscape enhancement for

[15] The City of Red Deer, 2006

	year round effect as well as any water conservation methods or strategies employed. Any proposed landscaping plan with a naturescaping component for new development or redeveloped site shall be subject to Development Authority approval. (8) The landscaping of boulevard and front yards shall include a mixture of coniferous/deciduous tree and shrubs. (11) The location, extent and type of plantings and other landscaping treatments shall be the satisfaction of the Development Authority. (14) A minimum of 15% of all Landscaped Area of developments requiring a landscaping plan shall consist of Naturescaping. (17) 25% of all front yards of detached, semi-detached and multi-attached dwelling units shall consist of landscaped area.
Part 5 Commercial Districts and Regulations	
Design Criteria	Developments shall be designed with green technologies and materials that reduce energy, waste and conserve water.
Overlay and Other Districts and Regulations	Irrigation systems installed at the time of the development of the site shall be high efficiency drip systems.
Part 7 Overlay and Other Districts and Regulations	
7.13 Eco Industrial Park Overlay District	i. Landscaping shall be completed using those species of plants, trees or shrubs that are suitable for xeriscaping, naturescaping, stormwater management, and/or rear yard screening. ii. Landscaping shall consist of a combination of flowers, grasses, mulch, trees, and/or shrubs. iii. A minimum of 15% of all Landscaped Area shall consist of Naturescaping or Xeriscaping. iv. Landscaping shall be designed to provide shading, climate protection and windbreaks to the principle building on the site. v. Access to the site shall be framed with landscaping islands. vi. If the building abuts a parking area, a 1m wide landscaping strip shall be provided immediately adjacent to and along the length of the building abutting the parking area in order to separate the building from the parking area or sidewalk that abuts the parking area. vii. A 1m wide landscaping strip, in addition to the landscaping strips provided pursuant to s.5(e) of this Overlay, shall be provided immediately adjacent to and along another side of the building. This landscaping strip

	will preferably be provided on the side of the building that is visible from a public roadway or be located to provide shading and climate protection for the building. viii. A 1m wide landscaping strip shall be provided along the entirety of the front yard of the site if the front yard of the site abuts a road. The landscaping strip will provide separation and soften the appearance of the front yard of the site. ix. If the rear yard of the site is visible from a road or highway, a 1.5m wide landscaping strip, incorporating trees and shrubs, shall be provided to screen the view of the rear yard from the road or highway. Rear yard screening may be supplemented by fencing. x. The area of a Green Roof may be included by the Development Authority in determining if required landscaping requirements are satisfied. xi. Irrigation systems installed at the time of the development of the site shall be high efficiency drip systems.

Table 13. City of Red Deer Municipal Development Plan

Municipal Development Plan[16]	
9.7 Green Infrastructure	The City should incorporate significant natural features as part of the overall infrastructure systems. This should include using existing wetlands as storm water management facilities and planting and preserving shrubs and trees to improve air quality.
9.13 City Owned Buildings	The City shall develop a policy regarding the environmental standards (e.g. LEED) which future buildings constructed or renovated for City use shall be required to achieve.
17.6 Water Supply from Red Deer River (Utilities)	The City shall seek to ensure future growth does not exceed the availability of the water supply from the Red Deer River and shall implement a water conservation strategy to make the best use of available water supplies.
17.7 Capacity of Red Deer River (Utilities)	Recognizing that the Province is responsible for allocations of water drawn from the Red Deer River, The City shall collaborate with other municipalities and other major stakeholders within the Red Deer River basin such as the Red Deer Municipal Users Group to ensure that at least 38% of the median annual flow of the Red Deer River is committed for allocations (i.e. use) within the Red Deer River basin in a manner that observes water conservation objectives to maintain the aquatic health of the Red Deer River.

[16] The City of Red Deer, 2013

18.2 Watershed Protection	The City shall participate in the activities of the Red Deer River Watershed Alliance in order to promote the effective integration of the management and use of land and water resources to ensure a legacy of ecological integrity and economic sustainability throughout the Red Deer River watershed. A key objective in watershed management will be to maintain the water quality in the Red Deer River at, or above, provincial standards.

Table 14. City of Red Deer Neighbourhood Planning and Design Standards

Neighbourhood Planning & Design Standards[17]	
Principle 7	
Resilient & Low Impact Neighbourhoods	7.6 Design neighbourhoods with green technologies and materials that reduce energy use, waste and conserve water while maximizing the livability and the life of the building.
	7.20 The use of potable water for outdoor use should be minimized through measures, such as the following: • Highly efficient irrigation systems including drip irrigation and soil moisture. • The capture and use of rainwater using rain barrels, cisterns and ponds, and • The use of drought tolerant and/or native plant landscaping.

Table 15. City of Red Deer Utilities Policy

Utility Policy[15]	
Utilities Improvements	The City shall investigate opportunities and technologies that provide cost effective improvements in the efficiency and/or environmental impacts of the provision of utility services.

Table 16. City of Red Deer Utilities Bylaw

Utility Bylaw (effective March 1, 2015)[18]	
Water Use Restrictions	The City, at such times and for such lengths of time as The City considers necessary or advisable, regulate, restrict or prohibit the use of water for use other than human use. The City may cause the water supply for any Customer who causes, permits or allows irrigation,

[17] The City of Red Deer, 2013
[18] The City of Red Deer, 2015

	wastage, exterior washing, or other non-human use in contravention of any such regulation, restriction or prohibition to be shut off until the Customer undertakes to abide by and comply with such regulation, restriction or prohibition.
Requirement To Use Low-Flow Plumbing Fixtures	Any person installing plumbing fixtures for any new construction or renovation project that requires a plumbing permit for a residential, commercial, industrial or institutional structure shall install only Low-Flow Plumbing Fixtures (not application to plumbing facilities installed for safety or emergency purposes including emergency safety showers and face/eye wash stations).

Water Rationing Policy

The City is currently preparing a water rationing policy. This will include a phased approach to implementing water rationing procedures, triggered by reservoir and river levels, drought conditions and other circumstances. Each phase will adopt increasingly stronger restrictions to water use by customers, such as odd/even watering days, specified watering hours, watering restrictions and watering bans.

Wetland Preservation

Wetlands play a critical role in filtering, purifying and improving the quality of water before it reaches the Red Deer River. As well, wetlands take in and store excess water during flood periods, helping to more evenly distribute Red Deer's water supply throughout the year. The City follows provincial legislation which governs wetland protection, including the Municipal Government Act, the Water Act and the Wetland Policy. The City also works closely with developers to minimize the disturbance of unprotected wetland areas, and is working towards utilizing existing wetlands instead of constructed wetlands in operations (e.g. wastewater treatment). The City is currently working towards developing a municipal wetland policy.

7.4 Corporate Leadership at City Facilities

Between 2011 and 2013, water use audits were conducted from selected City facilities. The audit data collected provided accurate information of facilities' water efficiency performances to support the development of facility-specific water budgets. The water budgets also served as baselines from which conservation opportunities could be calculated and savings measured.

From each audited facility, water efficiency recommendations were identified and shared with facility managers. Based on feedback from facility staff, specific water efficiency recommendations were identified as being most feasible to implement and were compiled into a Corporate Administrative Policy of water conservation standards for City facilities. This document guides the implementation of water conservation measures for all City facilities.

Existing water conservation, efficiency and productivity measures that have been adapted at City facilities include:

- *The Recreation Centre, RCMP Detachment, Civic Yards Building 200 and Building 300 meet LEED standard requirements*
- *Waterless urinals*
- *Low-flow toilets*
- *Low-flow taps*
- *Water-efficient landscaping*
- *Rainwater harvesting*
- *Monthly leak detections*
- *Hot water pipe insulation*
- *Water conservation signage*

7.5 Education and Outreach

Over the past ten years, The City has worked towards educating and engaging residents about water conservation practices.

World Water Day

Since 2012, World Water Day has become an annual celebration in Red Deer. It has strengthened partnerships with the Red Deer Public Library, Red Deer College, Red Deer River Watershed Alliance, Re-Think Red Deer and other local organizations. Celebrations over the years have included guest speakers and seminars, movie screenings and information booths for the public.

Classroom Presentations

The Environmental Educator delivers presentations to grade 4 classes in Red Deer as part of the "Waste in our World" unit in the school curriculum. Included in the presentations is a discussion on water conservation. Since 2009, over 120 presentations have been delivered to close to 1100 students in Red Deer. As well, Trout Unlimited Canada's stormwater education program, Yellow Fish Road, is offered annually to children who learn about the threats of stormwater pollution to Red Deer waters. Since 2010, 50 presentations have been made to over 1000 children and youth.

Toilet Rebate Program

The City provides rebates to residents who replace their toilets with low-flow toilets. Since the program was introduced in 2008, 3,299 households have replaced 4,370 toilets, saving approximately 138,000,000 L of water annually.

While the program has proven to be immensely popular, over the past three years the program has experienced a decrease in the number of participants – an average annual decrease of 15% since 2011. This may be attributed to the longevity of the program (many households have already replaced toilets since the inception of the program) and the 2008 bylaw that requires new dwellings be installed with low-flow toilets.

Water Saver Kit Giveaway

At the 2012 and 2013 Red Deer Home Shows, water saver kits were given away to attendees. The kits contained a household guide, toilet tank bank, shower timer, Teflon (plumber's) tape, sink aerators, drip gauge, hose repair kits, toilet dye tabs and a rain gauge.

Naturescaping Contest

In the summers of 2010 and 2011, a residential contest was held for residents who naturescaped their homes. Photo entries were judged based on degree of water conservation, landscape design and biodiversity.

Rain Barrels

In 2008, 300 rain barrels were sold to residents for $70, at cost (no rebates or tax credits were provided). To further encourage the sale of rain barrels, a contest was held with prizes awarded to the best decorated rain barrels. From 2009 to 2013, Waskasoo Environmental Education Society took over the sale of rain barrels.

Currently, a pilot program provides 150 rebates for residents to purchase rain barrels at a local retailer, on a first-come, first-served basis.

Public Events

The Environmental Services Department promotes water conservation and water quality at public outreach events, including the annual Red Deer Home Show and Let's Talk.

Red Deer River Watershed Alliance Ambassador Program

Three Environmental Initiatives staff have been recognized for their work through the Red Deer River Watershed Ambassador Program. The program awards individuals who exemplify their commitment to environmental sustainability within the watershed.

8.0 FUTURE WATER DEMAND

Based on existing water use rates and forecasted population growth, residential use is expected to increase by 78% from 2014 to 2041.

Table 17. Forecasted annual residential water demand[4]

Annual Residential Water Demand Forecast				
	2014	2021	2031	2041
Population Served	98,585	115,133	142,488	175,726
% increase from 2014		17	45	78
Annual Water Demand Increase (ML)		1,178	3,125	5,491
Current Water Demand (ML)	7,017			
Forecasted Water Demand (ML)		**8,195**	**10,142**	**12,508**

The regional customers have calculated growth projections for the next three years. Water use is expected to increase by 122% from 2014 to 2041 in Red Deer County. Water use in the NRDRWSC is expected to increase by 31% from 2014 to 2041.

Table 18. Forecasted annual Red Deer County water demand[19]

Annual Regional Water Demand Forecast: Red Deer County				
	2014	2021	2031	2041
Population Served (number of people)	18,351	22,569	30,331	40,763
% increase from 2014		23	65	122
Annual Water Demand Increase (ML)		74	210	392
Current Water Demand (ML)	321			
Forecasted Water Demand (ML)		**395**	**531**	**713**

Table 19. Forecasted annual North Red Deer River Water Services Commission (NRDRWSC) water demand[19]

Annual Regional Water Demand Forecast: North Red Deer River Water Services Commission (NRDRWSC)				
	2014	2021	2031	2041
Population Served (number of people)	45,506	48,789	53,893	59,531
% increase from 2014		7	18	31
Annual Water Demand Increase (ML)		199	508	850
Current Water Demand (ML)	2,758			
Forecasted Water Demand (ML)		**2,957**	**3,266**	**3,608**

[19] Alberta Municipal Affairs, 2014

Using data from Statistics Canada and business growth projects, ICI water demand is expected to increase by 15% over the next decade. Projections for 2031 and 2041 are unavailable.

Table 20. Forecasted annual ICI water demand[20]

Annual ICI Water Demand Forecast		
	2011	2021
Business Population (number of people)	53,095	61,095
% increase from 2011		15
Annual Water Demand Increase (ML)		590
Current Water Demand (ML)	3,915	
Forecasted Water Demand (ML)		**4,505**

By 2041, we can expect that over half of the existing WTP's annual system capacity will be reached. Assuming customers do not reduce their current water use rates, water demand will be double today's current demand. It is important to note that the above forecasts do not account for climate change and drought impacts, which could constrain our water supply and exacerbate demands. The forecasts also do not account for projected seasonal population growth, demand from incoming regional customers (e.g. Sylvan Lake), infrastructure deterioration and potential changes in customer behaviours and values around water conservation – which may all affect water supply and demand.

[20] Statistics Canada, 2011

9.0 TARGETS AND INITIATIVES

9.1 EMP Targets

The EMP currently outlines the following targets:

For residential users,

223 lpcd by 2015 (8% reduction from 2009 baseline measures)
206 lpcd by 2020 (15% reduction)
182 lpcd by 2035 (25% reduction)

For ICI users,

124 lpcd by 2015 (8% reduction)
115 lpcd by 2020 (15% reduction)
101 lpcd by 2035 (25% reduction)

The 2015 and 2020 targets have been surpassed. In 2014, residential use was 195 lpcd and ICI use was 112 lpcd. From 2009 to 2014, residential use decreased by 24% and ICI use decreased by 21%.

Figure 9. Residential Per Capita Daily Water Use

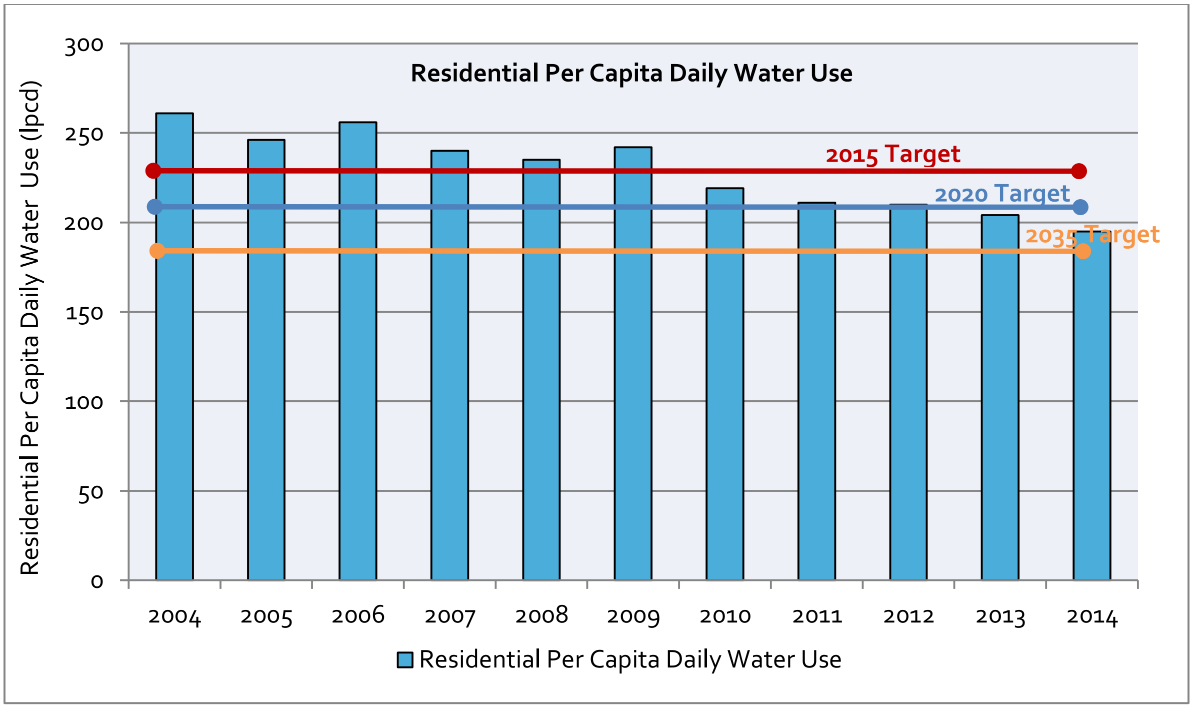
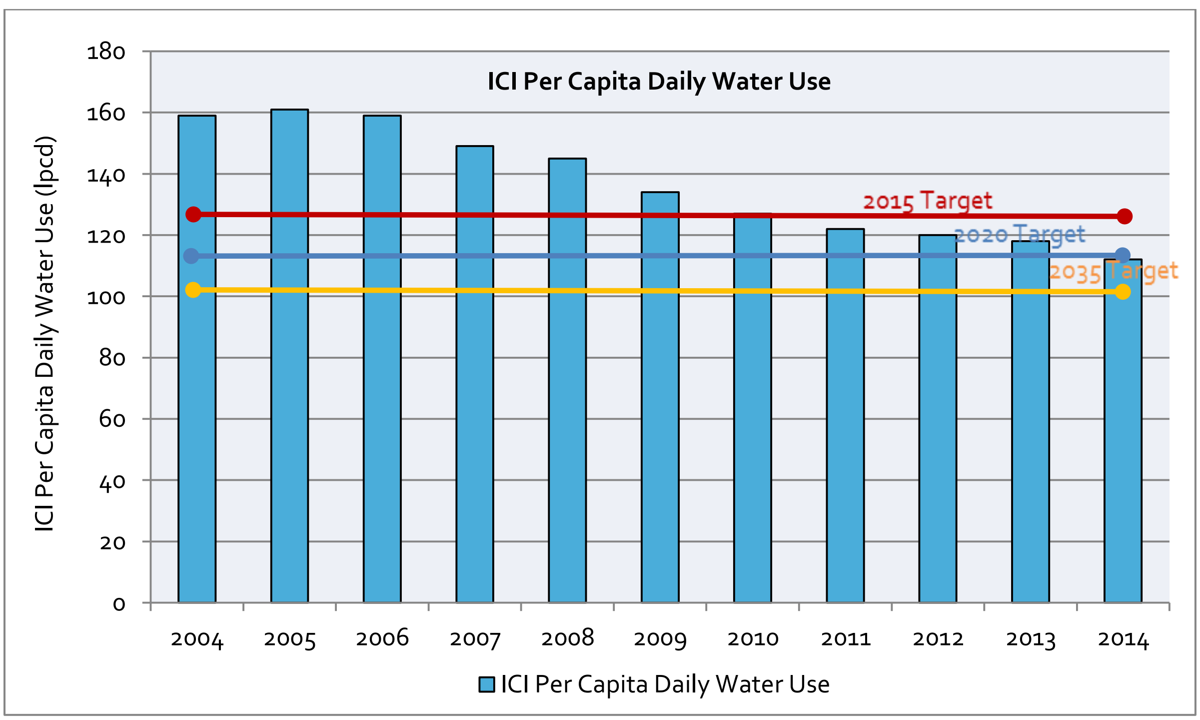


Figure 10. ICI Per Capita Water Use



9.2 EMP Priority Actions

The EMP sets out a number of priority actions for achieving its water conservation targets.

Table 21. EMP City Priority Actions

Action	Status	Priority Level
Prepare an Integrated Storm Water Management Plan.	In progress	Top Priority
Develop environmental standards for City buildings including water conservation measures, in accordance with policy 9.13 of the *Municipal Development Plan.*	Completed	Top Priority

Table 22. EMP Community Priority Actions

Action	Status	Priority Level
Review water, wastewater and storm water rate structures, which will draw attention to the value of water.	Completed	Top Priority
Replace water meters with Advanced Metering Infrastructure (AMI) technology in conjunction with replacement for electrical meters.	Ongoing	Long-Term

Table 23. EMP Additional Recommended Actions

Action	Status	Priority Level
Create a program to educate and assist ICI customers on how to do water audits and reduce their use.	Not completed	Medium-Term
Create a rainwater capture program to promote the use of rain water for irrigation, building on the success of the existing rain barrel sales program.	Ongoing	Top Priority
Work with public sector partners to encourage on-site rain water collection for irrigation and other uses.	Ongoing	Medium-Term
Continue to provide incentives for low flow fixtures and appliances.	Ongoing	Medium-Term
Promote the *Naturescaping* contest as a means to educate and encourage water conservation measures for residential irrigation; aim to increase participation by 100% in 2011 and by 50% each of the following years for three years.	Completed	Top Priority
Explore using waste water effluent for irrigation at Riverbend Golf Course.	In progress	Long-Term

9.3 CEP Targets

Red Deer is in a unique situation whereby one quarter of The City's total water use can be attributed to the ICI sector. As displayed below in Table 24, our total per capita water use is higher than some municipalities that see a smaller proportion of water used by the ICI sector. When looking at residential per capita water use, we are comparable to or further advanced than a number of Alberta municipalities.

Alberta municipalities are responsible for setting their own CEP targets. Some municipalities are under intense pressures to prevent serious water shortages in their watersheds and have outlined aggressive targets. Many municipalities are focusing efforts on reducing total per capita daily use (all sectors), while other municipalities are choosing to target specifically residential per capita daily use. Some municipalities have not set any targets and instead follow the AUMA targets. Our proposed targets build on the EMP water use targets: residential and ICI per capita daily water use. Red Deer is one of the only municipalities in Alberta that has set targets specific to the ICI sector.

Table 24. CEP Targets in Alberta Municipalities

Municipality	Current Water Use	Baseline Measure	CEP Target
City of Red Deer	Residential: 195 lpcd in 2014. Total: 355 lpcd in 2014.	Residential: 242 lpcd in 2009. ICI: 135 lpcd in 2009.	Reduce residential per capita use to 189 lpcd by 2020. Reduce residential per capita use to 169 lpcd by 2035. Reduce ICI per capita use to 105 lpcd by 2020. Reduce ICI per capita use to 95 lpcd by 2035. Maintain water losses at 10% or lower by 2020. Maintain water losses at 7% or lower by 2035.
City of Calgary	Residential: 220 lpcd in 2014. Total: 389 lpcd in 2014.	Total: 500 lpcd in 2003.	Reduce total per capita use to 350 lpcd by 3033.
City of Edmonton	Residential: 195 lpcd in 2014.	Residential: 227 lpcd in 2009.	None
City of Medicine Hat	Residential: 217 lpcd in 2015.	Residential: 325 lpcd in 2008.	Reduce residential per capita use to 276 lpcd by 2020.
City of Lethbridge	Residential: 191 lpcd in 2014.	None	None
Strathcona County	Residential: 190 lpcd	Residential: 238 lpcd in	Reduce residential per

	in 2015. Total: 317 lpcd in 2015.	2006.	capita use to 200 lpcd by 2020.
City of St. Albert	Total: 251 lpcd in 2014.	280 lpcd 2009	Reduce total per capita use to 200 lpcd by 2020. Maintain water losses at 7% or lower.
Town of Okotoks	Total: 285 lpcd in 2013.	None	Reduce total per capita use to 275 lpcd by 2017. Achieve a leak rate of 5% or lower.

Amendments to the EMP water conservation targets are recommended. Proposed targets are:

By 2020: a **22% reduction** from 2009 baseline measures, instead of the existing 15% reduction target. This would place water use at 189 lpcd for residents and 105 lpcd for ICI businesses.

By 2035: a **30% reduction** from 2009 baseline measures, instead of the existing 25% reduction target. This would place water use at 169 lpcd for residents and 95 lpcd for ICI businesses.

In support of the AUMA's municipal target of maintaining the volume of unaccounted for water at 10% of total water use, new targets for Red Deer have been developed:

By 2020: maximum of **10%** of total water use should be attributed to losses (apparent and real losses).

By 2035: maximum of **7%** of total water use should be attributed to losses (apparent and real losses).

9.4 CEP Initiatives

In support of the new water conservation targets, based on research and reviews of existing initiatives in other Canadian municipalities and to build on the existing EMP water conservation initiatives, a revised list of recommended initiatives was developed.

Each recommended initiative was ranked according to:

1. **Difficulty of development and implementation.** The term, "difficulty" accounts for four considerations. Each of these considerations was individually ranked according to level of difficulty. Their values were combined to calculate a weighted average difficulty rating (weights are indicated in parentheses below):
    a. Staffing (35%).
    b. Materials and other resources required (10%).
    c. Time frame (35%).
    d. Administrative, economic, cultural and societal barriers, degree of customer buy-in and potential competing interests (20%).

2. **Cost of development and implementation.** The total cost of development and implementation, including:
    a. Additional staffing wages.
    b. Material and equipment costs.

3. **Water savings.** The volume of water saved per year.

The water savings values were calculated and converted to **market values** (dollar cost of water savings) per year, using a value of $0.75/m^3.

Payback period was estimated by dividing the cost of each initiative by the market value.

While ICI water use normally accounts for City use, in this list of initiatives, they have been separated in this section to better indicate whether the recommended initiatives specifically target corporate or non-corporate water use. All water use data used in the calculations are from 2014 benchmarking.

While the lists of recommended initiatives in the below tables are based on research and consultation with stakeholders, they are not exhaustive. We anticipate seeing a number of the initiatives being developed and implemented in the coming years; yet, we acknowledge that some of the initiatives, once they have been more extensively researched and undergo feasibility studies, may be amended or removed from the CEP Plan as it evolves over time. As well, new initiatives may be introduced into the plan.

The detailed calculations and ranking of the initiatives can be viewed in Appendix A.

Table 25. Recommended Operational Initiatives

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
Develop a Pressure Management Strategy	Residential, ICI	Pressure management helps to achieve more consistent and lower water pressure levels through the distribution	5.25	6	7	$21,243/year saved by The City	2 months

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
		system, reducing the volume of water delivered. It also detects potential leaks or thefts in the system due to pressure fluctuations. Pressure management encompasses three key actions: 1) In certain neighbourhoods in the city where water pressure is deemed to be higher than necessary, pressure set points at water distribution pumps may be adjusted to lower the water pressure. 2) At certain times of the day, pressure-regulating					

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
		valves and system monitoring points are used to lower the water pressure. 3) Pressure transmitters that detect low pressure in hydrants may be strategically installed throughout the city to pinpoint leaks and thefts (hydrant monitoring).					
Explore the feasibility of setting up District Metering Areas (DMAs)	Residential, ICI	District Metering Areas (DMAs) help to address leaks before they appear at the surface. The city is divided into sections. Water flow is monitored in each of these sections – the flow of water entering the area is checked against theoretical flow. If	7.8	10	9	\$74,352/year saved by The City	54 years

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
		a significant difference between volumes is found, targeted leak detection actions are taken to pinpoint and repair the leaks. DMAs may be set up throughout the entire city, but if this is deemed unfeasible due to infrastructure costs, may be installed in new neighbourhood developments only.					
Water audits of all City-owned facilities	Residential, ICI, City	Complete water audits for all City owned or operated facilities. This helps to gain a better understanding of the sources of water losses and inefficiencies, and	5	5	3	\$6,404/year saved by The City	1 year and 4 months

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
		actions that should be taken to minimize the losses. Since audits have previously been completed for eleven City facilities, the methodology for carrying out the audits will be familiar.					
Explore the feasibility of requiring contractors to obtain water from bulk filling stations	City	Instead of allowing access to hydrants for potable water, contractors must obtain their water through pre-paid bulk filling stations. The intention is to discourage over-consumption, as currently contractors only need to report to The City on the volume of water obtained from hydrants.	4.8	2	5	\$10,622/year saved by The City	2 years and 3 months

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m³/year **4-6** = 10,000m³/year – 20,000 m³/year **7-10** = 20,000 m³/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/m³	Payback Period Cost ÷ Market Value
Explore stormwater harvesting, greywater re-use and wastewater effluent re-use opportunities at City facilities and land	City	Explore the possibility of stormwater, greywater and wastewater effluent re-use at municipal facilities/property for non-potable water uses, including washing fleet and equipment, toilet flushing, site irrigation, cooling and other industrial processes. At this time, stormwater and wastewater re-use is permitted for sub-irrigation, urinal flushing and toilet flushing only. For surface	6.25	2	7	$19,894/year saved by The City	3 months

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		irrigation/sprinklers, the development of a variance from the Alberta Plumbing Code is required. Some possible locations include City Hall Park (rainwater harvesting), Centennial Spray Park (water re-use), and Recreation facilities. Before installing any greywater systems, The City will need to wait until the Government of Alberta has released its guidelines for greywater recycling and water re-use in late 2016. Effluent re-use is restricted to Parks					

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		irrigation.					
Extend current City Hall Park soil amendments and irrigation practices to other irrigated City properties	City	Currently at City Hall Park, the following actions are taken which help to conserve water use: the use of a rain gauge, which helps with determining the appropriate output from the irrigation system and minimize excess water use on lawn, hand watering only for plants and shrubs, and the application of organic fertilizer and humic acid to improve soil quality and water retention. Using City Hall Park as a model, extend the use of these practices to other City properties.	5.3	2	7	$21,705/year saved by The City	6 months

Table 26. Recommended Regulatory Initiatives

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost 1-3 = 0-$50,000/year 4-6 = $50,000/year-$100,000/year 7-10 = $100,000/year+	Water Savings 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
Review Land Use Bylaw's landscaping standards to incorporate greater naturescaping and Low Impact Development practices related to the Engineering Design Guidelines	Residential, ICI	Naturescaping refers to the modification and enhancement of a lot or development to promote water efficiency and reduce dependence on fertilizers and pesticides. While naturescaping is already incorporated in the Land Use Bylaw, there are still opportunities to strengthen the minimum requirements, make the requirements more specific and detailed, and add Low Impact Development concepts (rain gardens, tree trenches, etc).	3.15	1	8	$40,778/year saved by The City, and residential and ICI sectors.	No costs, so payback is immediate. Over $40,000 may be saved per year.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost 1-3 = 0-$50,000/year 4-6 = $50,000/year-$100,000/year 7-10 = $100,000/year+	Water Savings 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
Create restrictions for the times of the day that hydrants can be used.	Residential, ICI	To prevent thefts at night, hydrants may only be used during specified hours. Emergency Services would be excluded from these time restrictions.	1.65	1	2	$4,249/year saved by The City.	4 months
Research and explore opportunities to update the agreement between regional water customers in the future so as to improve the consistency of water conservation messaging	Regional	There is a lack of uniformity and consistency in the water conservation messages and actions set out across municipalities. Messages and actions refer to drought management strategies and policies, and public educational campaigns. Research should be undertaken to determine if it is feasible to include a regional, collaborative approach to	1.9	1	5	$10,332/year saved by The City and regional sector.	No costs, so payback is immediate. Over $10,000 may be saved per year.

Initiative	**Target Sector** Residential ICI City Regional	**Description**	**Difficulty** 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	**Cost** 1-3 = 0-\$50,000/year 4-6 = \$50,000/year-\$100,000/year 7-10 = \$100,000/year+	**Water Savings** 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	**Market Value/Dollar Cost of Water Savings** Water Savings × \$0.75/m^3	**Payback Period** Cost ÷ Market Value
and actions across municipalities.		develop and implement specific water conservation strategies.					

Table 27. Recommended Education and Outreach Initiatives

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost 1-3 = 0-$50,000/year 4-6 = $50,000/year-$100,000/year 7-10 = $100,000/year+	Water Savings 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
Expand water conservation rebates to other appliances and/or items	Residential	Continue the Toilet Rebate and Rain Barrel Rebate Programs, and explore the expansion of rebates to water-efficient household appliances or landscaping resources, such as organic/inorganic mulch, rain gauges for irrigation and drought tolerant ground cover or artificial turf.	5.9	1	4	$8,805/year saved by The City and the residential sector.	1 year
Sell discounted water saver kits	Residential	Sell water saver kits to residents at an affordable price. The indoor water saver kit contains items such as a low flow showerhead, faucet sink aerators, and leak	4.2	1	2	$5,837/year saved by The City and the residential sector.	2 years and 9 months

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost 1-3 = 0-$50,000/year 4-6 = $50,000/year-$100,000/year 7-10 = $100,000/year+	Water Savings 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		detection dye tablets. The outdoor kit contains items such as a mechanical water timer, screw clamp hose mender, hose washers, and rain gauge.					
Develop a water efficiency audit and retrofit program	ICI	Building on the EMP's water conservation action of assisting ICI with conducting water audits, develop a program that provides financial support for institutional, commercial or industrial water audits and/or retrofits. Complimentary audits may be explored as an option for non-profit organizations and public educational institutions.	6.7	2	6	$15,128/year saved by The City and the ICI sector.	1 year
Explore the	Residential	Develop a program that	6.65	1	1	$1,158/year	8 years and 9

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost 1-3 = 0-$50,000/year 4-6 = $50,000/year-$100,000/year 7-10 = $100,000/year+	Water Savings 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
feasibility of developing a certification for water conserving homes		gives home sellers opportunities to certify homes as being "Water Conserving," provided that the homes meet certain water conservation criteria inside and around their homes (e.g. low-flow appliances, rain water harvesting, etc).				saved by The City and the residential sector.	months
Create an annual water efficiency excellence award	ICI	One ICI customer is awarded annually (or every two years), based on set criteria, including percentage of water savings over a specified period of time, water conservation innovation initiatives, staff and customer engagement, operational tools, and	6	1	3	$7,244/year saved by The City and the ICI sector.	1 year and 4 months

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost 1-3 = 0-$50,000/year 4-6 = $50,000/year-$100,000/year 7-10 = $100,000/year+	Water Savings 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		regulatory/policy tools.					
Create an Eco-Restaurant Certification Program	ICI	Create a program that certifies restaurants that meet certain environmental sustainability criteria for water conservation, energy efficiency, and waste diversion.	6.6	1	3	$7,244/year saved by The City and the ICI sector.	1 year and 4 months
Promote Low Impact Development concepts	Residential, ICI, City	Highlight, promote and support Low Impact Development (LID) concepts for residents, ICI customers and City facilities. These include rain gardens, tree trenches and green roofs.	6	1	10	$85,837/year saved by The City, and the residential and ICI sectors.	2 months
Showcase water conservation operations at	Residential	Install educational signs and displays at City buildings, including Recreation facilities, that	5.35	2	5	$13,145/year saved by The City and the	6 months

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost 1-3 = 0-$50,000/year 4-6 = $50,000/year-$100,000/year 7-10 = $100,000/year+	Water Savings 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
City facilities		showcase The City's leadership in water conservation work (Low Impact Development, water recycling and re-use, rainwater harvesting, etc). This could extend to open houses and tours of City facilities, to be continued throughout the 2019 Winter Games.				residential sector.	
Incorporate sustainability topics in Recreation programs for children and youth	Residential	Introduce concepts about water conservation, energy conservation, waste diversion and other sustainability topics to children and youth programs offered by Recreation.	6.4	1	1	$0.60/year saved by The City and the residential sector.	11,700 years
Explore the feasibility of	Residential	Explore the logistics of offering tours and/or	7.8	2	1	$10.50/year saved by	1,972 years

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty 1-3 = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers 4-6 = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers 7-10 = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost 1-3 = 0-$50,000/year 4-6 = $50,000/year-$100,000/year 7-10 = $100,000/year+	Water Savings 1-3 = 0-10,000 m^3/year 4-6 = 10,000m^3/year – 20,000 m^3/year 7-10 = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
offering tours of the WTP and WWTP.		virtual tours of the WTP and WWTP for members of the public, including school groups.				The City and the residential sector.	
Re-design the City water website as an interactive resource	Residential, ICI, City, regional	Design a comprehensive and interactive website that educates and informs residents about The City's water conservation initiatives, tips and guides to conserving water at home.	5.35	1	1	$65.25/year saved by The City and the residential sector.	154 years

10.0 IMPLEMENTATION PLAN

10.1 Funding Sources

Potential funding sources have been identified for each of the recommend initiatives in Table 28. *Costs To Be Recovered Through Savings* refers to those initiatives whose payback periods are five years or less; capital and operating expenses are expected to be recovered from dollar cost savings over the short-term. *Existing Work Plan Budget* refers to those initiatives which can be accommodated into existing work plan budgets. *Capital Detail Worksheet/Funding Adjustment Recommendation (FAR)* may be required for larger capital or operational initiatives. A FAR would also be required to fund a new, permanent, full-time staff position that will provide the capacity to oversee the development and implementation of the initiatives. *External Funding Sources* are an option for those initiatives that meet the requirements outlined in provincial or federal funds or grants. Examples of potential External Funding Sources include:

1. Federation of Canadian Municipalities Green Municipal Fund
2. Royal Bank of Canada Blue Water Project
3. TD Friends of the Environment
4. Red Deer & District Community Foundation

Table 28.Potential funding sources for CEP initiatives

CEP Recommended Initiatives	Costs To Be Recovered Through Savings Payback period is 1 year or less	Costs To Be Recovered Through Savings Payback period is 1-3 years	Costs To Be Recovered Through Savings Payback period is 3-5 years	Existing Work Plan Budget	Capital Detail Worksheet or Funding Adjustment Recommendation (FAR)	External Funding Sources
Develop a Pressure Management Strategy			X			
Explore the feasibility of setting up District Metering Areas (DMAs)					X Capital Detail Worksheet required for funding the capital cost of project	X
Water audits of all City-owned facilities		X				
Explore the feasibility of requiring contractors to obtain water from bulk filling stations		X				
Explore stormwater harvesting, greywater re-use and wastewater effluent re-use opportunities at City facilities and land	X					
Extend current City Hall Park soil amendments and irrigation practices to other irrigated City properties	X					
Review Land Use Bylaw's landscaping standards to incorporate greater naturescaping and Low Impact Development practices related to	X					

CEP Recommended Initiatives	Costs To Be Recovered Through Savings Payback period is 1 year or less	Costs To Be Recovered Through Savings Payback period is 1-3 years	Costs To Be Recovered Through Savings Payback period is 3-5 years	Existing Work Plan Budget	Capital Detail Worksheet or Funding Adjustment Recommendation (FAR)	External Funding Sources
the Engineering Design Guidelines						
Create restrictions for the times of the day that hydrants can be used	X					
Review the agreement between regional water customers for opportunities to require water conservation	X					
Expand water conservation rebates to other appliances and/or items		X				
Sell discounted water saver kits		X				
Develop a water efficiency audit and retrofit program	x					
Explore the feasibility of developing a certification for water conserving homes				X		X
Create an annual water efficiency excellence award		X				
Create an Eco-Restaurant Certification Program		X				
Promote Low Impact Development concepts	X					
Showcase water conservation operations at City facilities	X					
Incorporate sustainability topics in children, youth and family Recreation programs				X	X FAR required to fund the wage of 1 new, full-time staff	
Explore the feasibility				X	X FAR required to fund the wage of 1 new, full-	

CEP Recommended Initiatives	Costs To Be Recovered Through Savings Payback period is 1 year or less	Costs To Be Recovered Through Savings Payback period is 1-3 years	Costs To Be Recovered Through Savings Payback period is 3-5 years	Existing Work Plan Budget	Capital Detail Worksheet or Funding Adjustment Recommendation (FAR)	External Funding Sources
of offering tours of the WTP and WWTP					time staff (same position as above)	
Re-design the City water website as an interactive resource				X	X FAR required to fund the wage of 1 new, full-time staff (same position as above)	

10.2 Priority CEP Initiatives

Based on the ranking of the recommended initiatives, the following initiatives have been identified as being priority actions. These actions have low levels of difficulty, high annual water savings and/or short payback periods compared to the other initiatives. They will be the primary focus of The City over the next one to five years.

The following schedule indicates the departments responsible for program development and implementation, potential partners, and expected start dates for implementation.

Table 29. CEP Priority Actions Implementation Schedule

Initiative	Responsible Department	Potential Partners	Anticipated Start Date for Implementation
Explore stormwater harvesting, greywater re-use and wastewater effluent re-use opportunities at City facilities and land	Environmental Services	Public Works Parks	2019
Review Land Use Bylaw's landscaping standards to incorporate greater naturescaping and Low Impact Development practices related to the Engineering Design Guidelines	Planning	Engineering Environmental Services	2017
Create restrictions for the times of the day that hydrants can be used	Environmental Services		2017
Review the agreement between regional water	Environmental Services		2018

customers for opportunities to require water conservation			
Explore the feasibility of requiring contractors to obtain water from bulk filling stations	Environmental Services		2018
Develop a water efficiency audit and retrofit program	Environmental Services	Public Works	2019
Promote Low Impact Development concepts	Environmental Services	Engineering Planning Parks	2017
Showcase water conservation operations at City facilities	Environmental Services	Public Works Recreation	2018

10.3 Monitoring and Evaluation

While annual reporting will present yearly progress, environmental plans need to stay current to remain highly effective – meaning they must be regularly reviewed as targets and goals are reached and as conditions change, such as advances in technology, climate change, etc. As a planning tool and living document, the CEP Plan will be reviewed once every five years and will include updates about progress made for each of the recommended initiatives.

The five-year review will involve the following:

- *Review of the 2020 and 2035 targets using the 2009 baseline measures from the EMP.*
- *Reporting of the five-year results and achievements.*
- *Insert any changes that Council has already directed or adopted each year during annual reporting.*
- *Review (internally) the recommended initiatives and implementation schedule, analyze impacts to dates and analyze any opportunities to strengthen or update them.*
- *Engage and receive input from all relevant City departments as well as key external stakeholders.*
- *Review City plans and strategies adopted after the CEP Plan was adopted for any potential linkages.*
- *Present the five-year review findings to Council.*

11.0 DEFINITIONS

Unless otherwise indicated, the following definitions are borrowed from Alberta Environment's Glossary of Terms Related to Water and Watershed Management in Alberta.[21]

Effluent: Treated liquid released from a wastewater treatment process.

Evapotranspiration: The combination of evaporation from the surface of soils and vegetation, plus the transpiration of water through plant leaves and vegetation.

Freshwater: Non-saline water, with less than 4000 mg/L of total dissolved solids.

Full Cost Accounting: A method of accounting that captures all the costs (both cash and non-cash) relating to the provision of water services. It includes all operating and maintenance expenses, depreciation on assets, and provision for the replacement of capital assets employed in providing water services.[22]

Hydrologic Cycle: The process by which water evaporates from oceans and other water bodies, accumulates as water vapour in clouds, and returns to oceans and other bodies of water as rain and snow or as runoff from this precipitation or groundwater.

ICI: Industrial, Commercial and Institutional customers.

Infrastructure Leakage Index: A measure of current losses compared to unavoidable losses in a municipal water system. It is recognized as a performance indicator by the International Water Association (IWA) and is a recommended water audit method by the American Water Works Association (AWA).[23]

Naturescaping: The modification and enhancement of a lot or development to promote water efficiency and reduce the dependence on fertilizers and pesticides.[16]

Per Capita Use: A way to relate water use in a municipality to the population. It is calculated based on the average volume of water used per day divided by the population served.[23]

Potable Water: Drinking water; water that is provided by a waterworks system and is used for drinking, cooking, dishwashing, or other domestic purpose requiring water that is suitable for human use.

Raw Water: Water in its natural state, prior to any treatment for drinking.

Seasonal Water Use: Water use between the months of May to September.

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[21] Alberta Environment, 2008
[22] AUMA, 2011

Stormwater: Water discharged from a surface as a result of rainfall or snowfall.

Surface Water: Water bodies such as lakes, ponds, wetlands, rivers, and streams, as well as groundwater with a direct and immediate hydrological connection to surface water (e.g. water in a well beside a river).

Wastewater: A combination of liquid and water-carried pollutants from homes, businesses, industries, or farms; a mixture of water and dissolved or suspended solids.

Water Allocation: The permitted volume, rate and timing of a diversion of water outlined in a water licence. When water is permitted to be redirected for a use other than domestic purposes, it is referred to as an allocation.

Water Conservation: Any beneficial reduction in water use, loss or waste; water management practices that improve the use of water resources to benefit people or the environment.

Water Distribution System: An organized process and associated structures of pipes, valves, fittings, and accessories, including associated pressure reducing stations, that are used to convey potable water in a waterworks system to a service connection.

Water Efficiency: 1. Accomplishment of a function, task, process or result with the minimal amount of water feasible. 2. An indicator of the relationship between the amount of water needed for a particular purpose and the quantity of water used or diverted.

Water Licence: Provides the authority for diverting and using surface water or groundwater. The licence identifies the water source, the location of the diversion site, an amount of water to be diverted and used from that source, the priority of the "water right" established by the licence, and the conditions under which the diversion and use must take place.

Water Productivity: The amount of water that is required to produce a unit of any good, service, or societal value.

Watershed: An area of land that catches precipitation and drains it to a common point such as a marsh, stream, river or lake.

Water Re-use: Any beneficial use of the treated wastewater direction to a specific purpose other than the general release to the surface or subsurface environments.

Water Use: The total volume of water withdrawn from the river (the water source) for use.[23]

[23] World Resources Institute, 2013

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APPENDIX A

A.1. Recommended Operational Initiatives

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
Develop a Pressure Management Strategy	Residential, ICI	Pressure management helps to achieve more consistent and lower water pressure levels through the distribution system, reducing the volume of water delivered. It also detects potential leaks or thefts in the system due to pressure fluctuations.	<u>Staffing:</u> no extra staff required, but at least one staff member should have the capacity to assume the role of project manager. In addition, a consultant may be hired. Difficulty: 4	<u>Consultant:</u> Approximately $100/hour × 300 hours = $30,000. <u>Pressure transmitters for hydrants:</u> 2600 hydrants total, and 3% of these hydrants will have pressure	Total annual consumption in 2014 was 2,178,817 m^3, and losses account for 13% of this consumption = 283,246 m^3. Assuming that 10% of losses	Market value: 28,325 m^3/year × $0.75/$m^3$ = $21,243/year saved by The City.	Payback period: $89,000/year ÷ $21,243/year = 4 years and 2 months.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
		Pressure management encompasses three key actions: 1) In certain neighbourhoods in the city where water pressure is deemed to be higher than necessary, pressure set points at water distribution pumps may be adjusted to lower the water pressure. 2) At certain times of the day, pressure-regulating valves and system monitoring points are used to lower the water pressure. 3) Pressure transmitters that detect low pressure in hydrants may be strategically installed throughout	<u>Materials:</u> pressure transmitters, informational material (email, PSA, letters). Difficulty: 4 <u>Time frame:</u> 6 months to 1 year for planning and development; continual implementation (no time period). Difficulty: 7 <u>Barriers:</u> Residents and businesses that are active during late nights and are impacted by pressure drops may not be receptive to this project. Businesses may require a certain	transmitters = 78 hydrants. The cost of purchase and installation is \$5,000 each × 78 hydrants = \$390,000. <u>Pressure transmitters for 3 booster stations:</u> \$5,000 × 3 = \$15,000. <u>Hydrant monitoring:</u> \$10,000. <u>Informational material:</u> \$1,000. Total: \$446,000 in capital costs, spread over 5 years = \$89,000/year.	can be recovered through pressure management = 28,325 m^3/year. Total: 28,325 m^3/year. **Water savings rating: 7**		

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		the city to pinpoint leaks and thefts (hydrant monitoring).	pressure for their operations. As well, regional customers will be impacted and need to be informed and engaged. Difficulty: 5 **Average difficulty rating: 5.25**	**Cost rating: 6**			
Explore the feasibility of setting up District Metering Areas (DMAs)	Residential, ICI	District Metering Areas (DMAs) help to address leaks before they appear at the surface. The city is divided into sections. Water flow is monitored in each of these sections – the flow of water entering the area is checked against theoretical flow. If a significant difference between	Staffing: 1 extra full-time staff required. Difficulty: 7 Materials: DMA infrastructure. Difficulty: 8 Time frame: 5 years for planning, development and trialing; continual	Staffing: 1 extra full-time staff member = $40/hour +25.50% burden = $97,890/year ÷ 4 projects = $24,473/year. DMA infrastructure and implementation: up to $20 million.	Total annual consumption in 2014 was 2,178,817 m^3, and losses account for 13% of this consumption = 283,246 m^3. Assuming that 35% of losses can be	Market value: 99,136 m^3/year × $0.75/$m^3$ = $74,352/year saved by The City.	Payback period: $4 million/year ÷ $74,352/year = 54 years.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		volumes is found, targeted leak detection actions are taken to pinpoint and repair the leaks. DMAs may be set up throughout the entire city, but if this is deemed unfeasible due to infrastructure costs, may be installed in new neighbourhood developments only.	implementation (no time period). Difficulty: 9 Barriers: high capital costs of the project may raise concerns. Difficulty: 7 **Average difficulty rating: 7.8**	Total: up to $20 million in capital costs, spread over 5 years = $4 million/year. $4 million/year + $24,473/year = over $4 million/year. **Cost rating: 10**	recovered through DMAs = 99,136 m^3/year. Total: 99,136 m^3/year. **Water savings rating: 9**		
Water audits of all City-owned facilities	Residential, ICI, City	Complete water audits for all City owned or operated facilities. This helps to gain a better understanding of the sources of water losses and inefficiencies, and actions that should be taken to minimize the losses. Since audits have previously been	Staffing: 1 existing staff member or a hired consultant to conduct the audits, and capacity and engagement needed from 1 facility manager/staff per facility. There are approximately 75 insured facilities that	Consultant: Approximately $100/hour × 300 hours = $30,000. Action taken to improve conservation in facilities: $100,000/facility.	Assuming that after audits are completed and action is taken to improve water conservation and efficiency, City facilities save up to 5% of the total	Market value: 8,538 m^3/year × $0.75/$m^3$ = $6,404/year saved by The City.	Payback period: $80,000/year ÷ $6,404/year = 1 year and 4 months.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		completed for eleven City facilities, the methodology for carrying out the audits will be familiar.	may be eligible to be audited. Difficulty: 5 <u>Materials:</u> None. Difficulty: 1 <u>Time frame:</u> 1-2 years for planning and development, 2 years for implementation. Difficulty: 5 <u>Barriers:</u> Facility staff may be concerned about the commitment/time required to participate in the audits, which may take away from their immediate work/priorities. Water	Total: $100,000 in capital costs/facility, spread over 2 years = $50,000/year. $50,000/year + $30,000/year = $80,000/year. **Cost rating: 5**	annual City facilities consumption (170,759 m^3 in 2014) = save 8,538 m^3/year. The volume of savings is expected to vary, depending on the upgrades that need to be made at the facilities. Total: 8,538 m^3/year. **Water savings rating: 3**		

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
			audits do not necessarily lead to action being taken to reduce potable water consumption (especially if initial costs of upgrades are determined to be high). Difficulty: 7 **Average difficulty rating: 5**				
Explore the feasibility of requiring contractors to obtain water from bulk filling stations	City	Instead of allowing access to hydrants for potable water, contractors must obtain their water through pre-paid bulk filling stations. The intention is to discourage over-consumption, as currently contractors	<u>Staffing:</u> no extra staff required, but at least one staff member needs capacity to develop informational/outreach material for contractors, as well as purchase the bulk filling stations.	<u>Bulk filling stations and installation:</u> \$50,000 each ×3 stations = \$150,000. Total: \$150,000 in capital costs, spread over 5 years = \$30,000/year.	Total annual consumption in 2014 was 2,178,817 m^3, and losses account for 13% of this consumption = 283,246 m^3.	Market value: 14,162 m^3/year × \$0.75/m^3 = \$10,622/year saved by The City.	Payback period: \$30,000/year ÷ \$10,622/year = 2 years and 3 months.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		only need to report to The City on the volume of water obtained from hydrants.	Difficulty: 3 <u>Materials:</u> Bulk filling stations (2-3). Difficulty: 3 <u>Time frame:</u> 2 years for planning and development, continual implementation. Difficulty: 7 <u>Barriers:</u> Bulk filling stations are costly to purchase and install. Difficulty: 5 **Average difficulty rating: 4.8**	**Cost rating: 2**	Assuming that 5% of losses can be recovered through bulk filling stations = 14,162 m^3/year. Total: 14,162 m^3/year. **Water savings rating: 5**		
Explore	City	Explore the possibility	<u>Staffing:</u> no extra staff	<u>Rainwater</u>	Looking at City	Market	Payback

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
stormwater harvesting, greywater re-use and wastewater effluent re-use opportunities at City facilities and land		of stormwater, greywater and wastewater effluent re-use at municipal facilities/property for non-potable water uses, including washing fleet and equipment, toilet flushing, site irrigation, cooling and other industrial processes. At this time, stormwater and wastewater re-use is permitted for sub-irrigation, urinal flushing and toilet flushing only. For surface irrigation/sprinklers, the development of a variance from the Alberta Plumbing Code	required, but will need dedicated staff to investigate the feasibility of stormwater harvesting and water re-use systems in City facilities. Difficulty: 3 <u>Materials:</u> rainwater harvesting and greywater system requires large cisterns for storage, while effluent re-use requires trucks for transportation. Difficulty: 6 <u>Time frame:</u> 3 years for planning, development and trialing, and	<u>harvesting:</u> $20,000/facility. <u>Greywater harvesting:</u> $10,000-$20,000 per facility. <u>Effluent re-use:</u> minimal costs (just transportation costs involved with trucking effluent from the WWTP to locations): $1,000/year. Total: up to $20,000/facility in capital costs, spread over 5 years = $4,000/year/facility. $4,000 +	Hall Park irrigation: <u>Rainwater harvesting:</u> Total annual irrigation volume at City Hall Park in 2014 was 26,525 m^3. Total rainfall in Red Deer from May to September 2014 was 400.8 mm. Using City Hall as an example, the roof size is 1521 m^2 × 0.4008 m × 0.8 (runoff coefficient that accounts for	value: 8,538 26,525^3/year × $0.75/$m^3$ = $19,894/year saved by The City.	period: $20,000/year ÷ $19,894/year = 3 months.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		is required. Some possible locations include City Hall Park (rainwater harvesting), Centennial Spray Park (water re-use), and Recreation facilities. Before installing any greywater systems, The City will need to wait until the Government of Alberta has released its guidelines for greywater recycling and water re-use in late 2016. Effluent re-use is restricted to Parks irrigation.	continual implementation. Difficulty: 8 <u>Barriers:</u> the capital cost of installing these systems may raise concerns. Before installing any greywater systems, The City will need to wait until the Government of Alberta has released its guidelines for greywater recycling and water re-use in late 2016. Effluent re-use is restricted to Parks irrigation. Nutrient concentrations in the effluent may be a	$1,000/year = $5,000/year. **Cost rating: 2**	losses on roof) = total volume of rainfall collected is 488 m^3. <u>Greywater harvesting:</u> Total water use at City Hall in 2014 was 2,011 m^3. Assuming that 50% of total water used can be greywater, water savings can be 1,006 m^3. <u>Effluent re-use:</u> Total effluent in 2014 14,438,848 m^3, so water		

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
			concern. Difficulty: 9 **Average difficulty rating: 6.25**		savings are up to 26,525 m^3/year. Total: Up to 26,525 m^3/year at City Hall alone, depending on which of the systems are implemented. **Water savings rating: 7**		
Extend current City Hall Park soil amendments and irrigation practices to other irrigated City properties	City	Currently at City Hall Park, the following actions are taken which help to conserve water use: the use of a rain gauge, which helps with determining the appropriate output from the irrigation	<u>Staffing:</u> no extra staff required, but each irrigation site requires a staff member who has the time/capacity to carry out the practices throughout the growing season.	<u>Rain gauge:</u> $500. <u>Organic fertilizer and humic acid, and application of them:</u> $2,000/year/site. Note that the cost goes down every	<u>Irrigation water used in 2014:</u> 306,939 m^3. Reported net water use reduction of 66% at City Hall Park since the	Market value: 28,940 m^3/year × $0.75/$m^3$ = $21,705/year saved by The City.	Payback period: $12,000/year ÷ $21,705/year = 6 months.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
		system and minimize excess water use on lawn, hand watering only for plants and shrubs, and the application of organic fertilizer and humic acid to improve soil quality and water retention. Using City Hall Park as a model, extend the use of these practices to other City properties.	Difficulty: 3 <u>Materials:</u> rain gauge and associated connection materials, organic fertilizer, humic acid. Difficulty: 4 <u>Time frame:</u> 1-2 years of planning and development, continual implementation (no time period). Difficulty: 7 <u>Barriers:</u> High capital costs are a deterrent, despite the long-term payback and environmental benefits. It takes at	year due to overall improvements in soil health (reduced requirements for fertilizer). $2,000 × 6 City irrigation sites = $12,000/year. Total: $500 in capital costs, plus $12,000/year, although this cost will decrease over time as lower quantities of fertilizers will be needed = $12,000/year **Cost rating: 2**	amendments were implemented in 2009. Assuming all irrigated sites adapt the same principles, annual City irrigation savings could be 202,580 m^3. Total: 202,580 m^3 over 7 years = 28,940 m^3/year. **Water savings rating: 7**		

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
			least 3 years for results to be observed (soil health improvement, irrigation requirements are reduced). Difficulty: 7 **Average difficulty rating: 5.3**				

A.2. Recommended Regulatory Initiatives

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
Review Land Use Bylaw's landscaping standards to incorporate greater naturescaping and Low Impact Development practices related to the Engineering Design Guidelines	Residential, ICI	Naturescaping refers to the modification and enhancement of a lot or development to promote water efficiency and reduce dependence on fertilizers and pesticides. While naturescaping is already incorporated in the Land Use Bylaw, there are still opportunities to strengthen the minimum requirements, make the requirements more specific and detailed, and add Low Impact Development concepts (rain gardens, tree trenches, etc).	<u>Staffing:</u> no extra staff required, but at least one staff should have the capacity staff to inspect properties and ensure that the bylaw is being followed. As well, one staff member from Planning should have the capacity to conduct research and revisions of the bylaw. Difficulty: 3	None. **Cost rating: 1**	Assuming that strengthening the bylaw will result in a 0.5% reduction in residential and ICI annual consumption (10,874,228 m^3) = 54,371 m^3. Total: 54,371 m^3/year. **Water savings rating: 8**	Market value: 54,371 m^3/year × $0.75/$m^3$ = $40,778/year saved by The City, and residential and ICI sectors.	No costs, so payback is immediate. Over $40,000 may be saved per year.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
			<u>Materials:</u> none. Difficulty: 1 <u>Time frame:</u> 1-2 years for research and planning, and 1 year for implementation. Difficulty: 4 <u>Barriers:</u> May receive criticism from developers, businesses, and residents about stricter regulations. In addition, inspecting				

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
			developments will be challenging. Difficulty: 3 **Average difficulty rating: 3.15**				
Create restrictions for the times of the day that hydrants can be used.	Residential, ICI	To prevent thefts at night, hydrants may only be used during specified hours. Emergency Services would be excluded from these time restrictions.	Staffing: none. Difficulty: 1 Materials: Informational material (PSA, email, letters, social media) to educate and engage the public about the	Small cost associated with developing informational material: $1,500. Total: $1,500/year. **Cost rating: 1**	Total annual consumption in 2014 was 2,178,817 m^3, and losses account for 13% of this consumption = 283,246 m^3. Assuming that 2% of losses can be recovered	Market value: 5,665 m^3/year × $0.75/$m^3$ = $4,249/year saved by The City.	Payback period: $1,500/year ÷ $4,249/year = 4 months.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
			importance of self-policing and reporting any hydrant uses at night. Difficulty: 2 <u>Time frame:</u> 1 year for development and implementation. Difficulty: 2 <u>Barriers:</u> Monitoring and ensuring that the hydrants are not being used at night will be		through hydrant time restrictions = 5,665 m^3/year. Total: 5,665 m^3/year. **Water savings rating: 2**		

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
			challenging, aside from depending on the public/self-policing. Difficulty: 2 **Average difficulty rating: 1.65**				
Research and explore opportunities to update the agreement between regional water customers in the future so as to improve the	Regional	There is a lack of uniformity and consistency in the water conservation messages and actions set out across municipalities. Messages and actions refer to drought management strategies and policies, and public educational campaigns. Research	<u>Staffing:</u> no extra staffing required, but one staff member from Water Section will need to be available to follow up with the regional customers every year to ensure	None. **Cost rating: 1**	Assuming that regional customers reduce annual seasonal regional consumption (1,377,586 m^3 from May to September 2014) by 1% = 13,776 m^3.	Market value: 13,776 m^3/year × $0.75/$m^3$ = $10,332/year saved by The City and regional sector.	No costs, so payback is immediate. Over $10,000 may be saved per year.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
consistency of water conservation messaging and actions across municipalities.		should be undertaken to determine if it is feasible to include a regional, collaborative approach to develop and implement specific water conservation strategies.	that the details of the agreement are being followed. Difficulty: 2 Materials: none. Difficulty: 1 Time frame: 1 year for development and implementation. Difficulty: 2 Barriers: Regional customers may not be receptive		Total: 13,776 m^3/year. **Water savings rating: 5**		

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
			to the idea of mandatory water conservation actions outlined in the agreement. Difficulty: 2 **Average difficulty rating: 1.9**				

A.3. Recommended Education and Outreach Initiatives

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
Expand water conservation rebates to other appliances and/or items	Residential	Continue the Toilet Rebate and Rain Barrel Rebate Programs, and explore the expansion of rebates to water-efficient household appliances or landscaping resources, such as organic/inorganic mulch, rain gauges for irrigation and drought tolerant ground cover or artificial turf.	<u>Staffing:</u> require one dedicated staff member to oversee the development and implementation water conservation programs, including processing rebates. Difficulty: 7 <u>Materials:</u> Informational material and application forms for residents.	Currently an annual budget of \$30,000/year is used to cover both the Toilet Rebate and Rain Barrel Rebate programs. This could also be used to cover the cost of the other rebates. Ideally, though, a larger budget would allow for more rebates to be bought: \$50,000.	<u>Low-flow toilets</u>: Replacing one 20 L toilet with 6 L toilet = 14 L savings/flush × 5 flushes/day × 365 days/year = 25,550 L/year. 25,550 L/year/toilet. Assuming 400 toilets are replaced per year = 10,220 m^3/year. <u>Rain barrels</u>: Total rainfall in Red Deer in May, June, July, August and	Market value: 11,740 m^3/year × \$0.75/m^3 = \$8,805/year saved by The City and the residential sector.	Payback period: \$8,801/year ÷ \$8,805/year = 1 year.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
			Difficulty: 2 <u>Time frame:</u> 2 years for planning and development, continual implementation (or until available annual funding is exhausted). Difficulty: 7 <u>Barriers:</u> the time/capacity required to oversee and process the rebates is significant enough that a dedicated	In addition, a full-time, permanent staff will require an annual salary: $36/hour + 25.50% burden = $88,101 ÷ 10 projects = $8,810/year. Total: $8,801/year. **Cost rating: 1**	September 2014 was 400.8 mm. Assuming an average residential rooftop size of 2,000 square feet = 186 m^2 × 0.4008 m × 0.8 (runoff coefficient to account for losses) × 0.3 (assuming there are 3 downspouts and only 1 rain barrel to capture the rainfall) = total volume of rainfall collected is 18 m^3 × 200 homes = 3,578 m^3/year could be collected by rain barrels.		

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			staff member is required for this project. Difficulty: 4 **Average difficulty rating: 5.9**		The volume of water actually used to irrigate the average garden: 200 sq feet= 19 m^2 requires 1 inch of water/week (2.5 cm) = 0.475m^3 × 16 weeks × 200 people = 1,520 m^3/year Total: at least 11,740 m^3/year. **Water savings rating: 4**		
Sell discounted water saver kits	Residential	Sell water saver kits to residents at an affordable price. The indoor water saver kit contains items	<u>Staffing:</u> require one dedicated staff member to oversee the	<u>Small cost associated with developing informational</u>	<u>Low-flow showerheads</u> give 10.5L savings/min. Assuming a shower	Market value: 7,782 m^3/year × \$0.75/m^3 =	Payback period: \$15,520/year ÷ \$5,837/year = 2 years and 9

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × \$0.75/m^3	Payback Period Cost ÷ Market Value
		such as a low flow showerhead, faucet sink aerators, and leak detection dye tablets. The outdoor kit contains items such as a mechanical water timer, screw clamp hose mender, hose washers, and rain gauge.	development and implementation water conservation programs, including selling water saver kits. Difficulty: 7 <u>Materials:</u> contents of the kits. Difficulty: 2 <u>Time frame:</u> 6 months for development and implementation. Difficulty: 1	<u>material:</u> \$1,500. Total: \$1,500/year. **Cost rating: 1**	takes 10 minutes/day, 365 days/year = 38,325 L/person/year × 100 people = 3,833 m^3/year. <u>Faucet sink aerators</u> give 2.6L savings/min. Assuming faucets are run for 10 minutes/day, 365/days/year = 9,490L/person/year ×100 people = 949 m^3/year. <u>Leak detection dye tablets</u>: Assuming that a toilet leaks 400 L/day and the	\$5,837/year saved by The City and the residential sector.	months.

Initiative	Target Sector Residential ICI City Regional	Description	Difficulty **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	Cost **1-3** = 0-$50,000/year **4-6** = $50,000/year-$100,000/year **7-10** = $100,000/year+	Water Savings **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	Market Value/Dollar Cost of Water Savings Water Savings × $0.75/$m^3$	Payback Period Cost ÷ Market Value
			<u>Barriers:</u> It will be challenging to follow up with those who purchase the kits to find out if they actually use the kits to help reduce water use. As well, not all components of the kit may be used. A community-based social marketing approach may need to be taken to address this barrier and maximize the likelihood that the items in the kits		leak is not detected for 3 days = 1200L/day = 1200L × 100 people = 120 m^3/year. <u>Mechanical water timer:</u> Assuming a sprinkler runs for 1 hour/day instead of 2 hours/day a consumption rate of 950 L/hour, for 16 days/year = save 15,200 L/year × 100 = 1,520 m^3/year. <u>Screw clamp hose mender:</u> Assuming a leak goes unfixed for 3 days and loses 50 L/day =		

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			will be installed properly. Difficulty: 6 **Average difficulty rating: 4.2**		150L/year × 100 people = 15 m^3/year. <u>Hose washer:</u> Hose washers fulfill similar tasks as screw clamp hoses = 15 m^3/year. <u>Rain gauge:</u> In 2014, there were 7 weeks where total rainfall was greater than 25 mm (recommended watering depth). Assuming a residential irrigation is set up to automatically deliver 950 L		

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					water/hour, 2 hours/day, and 7 fewer days are watered as result of the gauge = save 13,300 L/year × 100 people = 1,330 m^3/year. Total savings: 7,782 m^3/year. **Water savings rating: 2**		
Develop a water efficiency audit and retrofit program	ICI	Building on the EMP's water conservation action of assisting ICI with conducting water audits, develop a program that provides financial support for institutional, commercial or industrial	<u>Staffing:</u> require one dedicated staff member to oversee the development and implementation water conservation	<u>Staffing:</u> a full-time, permanent staff will require an annual salary: \$36/hour + 25.50% burden	Assuming that up to 0.5% of annual ICI consumption (4,034,002 m^3 in 2014) may be saved, approximately 20,170 m^3/year.	Market value: 20,170 m^3/year × \$0.75/m^3 = \$15,128/year saved by The City and the ICI	Payback period: \$14,020/year ÷ \$15,128/year = 1 year.

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		water audits and/or retrofits. Complimentary audits may be explored as an option for non-profit organizations and public educational institutions.	programs, including developing and implementing the audit and retrofit program. May need to hire a consultant to conduct the complimentary audits. Difficulty: 8 <u>Materials:</u> resources to provide to ICI customers to help them conduct audits. Difficulty: 6	= \$88,101 ÷ 10 projects = \$8,810/year. <u>Consultant:</u> Approximately \$40/hour × 100 hours = \$4,000. <u>Informational resources and promotional material:</u> \$3,000. Total: \$14,020/year. **Cost rating: 2**	Total: 20,170 m^3/year. **Water savings rating: 6**	sector.	

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			Time frame: 2 years for planning and development, 3 years for implementation. Difficulty: 6 Barriers: It may be difficult to engage ICI customers to participate in conducting their own audits; will need to follow up with them to find out if the audits have been completed. **Average difficulty**				

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			rating: 6.7				
Explore the feasibility of developing a certification for water conserving homes	Residential	Develop a program that gives home sellers opportunities to certify homes as being "Water Conserving," provided that the homes meet certain water conservation criteria inside and around their homes (e.g. low-flow appliances, rain water harvesting, etc).	Staffing: require one dedicated staff member to oversee the development and implementation water conservation programs, including the certification for water conserving homes. Will also require capacity from the Home Builders' Association and potentially other external partners to assist with conducting	Staffing: a full-time, permanent staff will require an annual salary: \$36/hour + 25.50% burden = \$88,101 ÷ 10 projects = \$8,810/year. Informational resources and promotional material: \$3,000. Total: \$10,020/year.	Low-flow toilets save: 25,550 L/year/toilet. Assuming 10 houses are certified in one year, with each house having 2 toilets, placed = 511 m³/year. Rain barrels: In May, June, July and August 2014, Red Deer received 456.8 mm precipitation. Assuming an average residential rooftop size of 2,000 square feet = 186 m² × 0.4568 m	Market value: 1,544 m³/year × \$0.75/m³ = \$1,158/year saved by The City and the residential sector.	Payback period: \$10,0200/year ÷ \$1,158/year = 8 years and 9 months.

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			inspections of homes. Difficulty: 8 <u>Materials:</u> informational and promotional material, certificates. Difficulty: 2 <u>Time frame</u>: 1-2 years for planning and development, continual implementation (no time period). Difficulty: 7	**Cost rating: 1**	× 0.7 (runoff coefficient to account for losses)) × 0.3 (assuming there are 3 downspouts and only 1 rain barrel to capture the rainfall) = total volume of rainfall collected is 18 m^3 × 10 homes = 178 m^3/year could be collected by rain barrels. The volume of water actually used to irrigate the average garden: 200 sq feet= 19 m^2 requires 1 inch of		

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			<u>Barriers:</u> Potential level of interest for homeowners to participate is difficult to gauge – will need to thoroughly communicate potential benefits to incent them put the effort into certifying their homes. Difficulty: 6 **Average difficulty rating: 6.65**		water/week (2.5 cm) = 0.475m^3 × 16 weeks × 10 people = 76 m^3/year. <u>Low-flow showerheads</u> give 10.5L savings/min. Assuming a shower takes 10 minutes/day, 365 days/year = 38,325 L/person/year × 2 people/house × 10 houses = 767 m^3/year. <u>Faucet sink aerators</u> give 2.6L savings/min. Assuming faucets		

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					are run for 10 minutes/day, 365/days/year = 9,490L/person/year × 2 people/house × 10 houses = 190 m^3/year. Total: 1,544 m^3/year. **Water savings rating: 1**		
Create an annual water efficiency excellence award	ICI	One ICI customer is awarded annually (or every two years), based on set criteria, including percentage of water savings over a specified period of time, water conservation innovation	Staffing: require one dedicated staff member to oversee the development and implementation water conservation	Staffing: a full-time, permanent staff will require an annual salary: \$36/hour + 25.50% burden	Assuming that the program results in a 0.25% reduction in annual ICI consumption (3,863,243 m^3 in 2014) = 9,658 m^3/year.	Market value: 9,658 m^3/year × \$0.75/m^3 = \$7,244/year saved by The City and the ICI	Payback period: \$10,020/year ÷ \$7,244/year = 1 year and 4 months.

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		initiatives, staff and customer engagement, operational tools, and regulatory/policy tools.	programs, including the award program. Difficulty: 7 <u>Materials:</u> promotional materials and set of criteria for applicants to refer to. Difficulty: 3 <u>Time frame:</u> 1 year for planning and development, continual implementation (no time period).	= \$88,101 ÷ 10 projects = \$8,810/year. <u>Informational resources and promotional material:</u> \$3,000. Total: \$10,020/year. **Cost rating: 1**	Total: 9,658 m^3/year. **Water savings rating: 3**	sector.	

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			Difficulty: 7 Barriers: Will need capacity (internally and with our partners) to inspect homes to ensure that they meet the criteria. Difficulty: 4 **Average difficulty rating: 6**				
Create an Eco-Restaurant Certification Program	ICI	Create a program that certifies restaurants that meet certain environmental sustainability criteria for water conservation, energy efficiency, and waste diversion.	Staffing: require one dedicated staff member to oversee the development and implementation water conservation	Staffing: a full-time, permanent staff will require an annual salary: $36/hour + 25.50% burden	Assuming certification results in a 0.25% reduction in ICI consumption (3,863,243 m^3) = 9,658 m^3.	Market value: 9,658 m^3/year × $0.75/$m^3$ = $7,244/year saved by The City and the ICI	Payback period: $10,020/year ÷ $7,244/year = 1 year and 4 months.

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			programs, including the eco-restaurant program. Difficulty: 7 <u>Materials:</u> promotional materials and set of criteria for applicants to refer to. Difficulty: 3 <u>Time frame:</u> 1 year for planning and development, continual implementation (no time period).	= $88,101 ÷ 10 projects = $8,810/year. <u>Informational resources and promotional material:</u> $3,000. Total: $10,020/year. **Cost rating: 1**	**Water savings rating: 3**	sector.	

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			Difficulty: 7 <u>Barriers:</u> Will need capacity to inspect restaurants to ensure that they meet the criteria. Difficulty: 7 **Average difficulty rating: 6.6**				
Promote Low Impact Development concepts	Residential, ICI, City	Highlight, promote and support Low Impact Development (LID) concepts for residents, ICI customers and City facilities. These include rain gardens, tree trenches and green roofs.	<u>Staffing:</u> require one dedicated staff member to oversee the development and implementation of water conservation programs,	<u>Staffing:</u> a full-time, permanent staff will require an annual salary: \$36/hour + 25.50% burden = \$88,101 ÷ 10	Assuming that LID implementation (through development of LID sites, education and awareness) results in a 1% reduction in residential, ICI	Market value: 110,450 m^3/year × \$0.75/m^3 = \$85,837/year saved by The City, and the	Payback period: \$10,020/year ÷ \$85,837/year = 2 months.

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			including LID promotions. Difficulty: 7 <u>Materials:</u> Promotional material. Difficulty: 2 <u>Time frame:</u> 6 months to 1 year for planning and development, 3 years for implementation. Difficulty: 5 <u>Barriers:</u> Difficult to measure	projects = \$8,810/year. <u>Informational resources and promotional material:</u> \$3,000. Total: \$10,020/year. **Cost rating: 1**	(including City) consumption (11,044,987 m^3) = 110,450 m^3. Total: 110,450 m^3. **Water savings rating: 10**	residential and ICI sectors.	

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			success and whether or not residents and ICI customers adapt LID principles. As well, The City should lead by example first, so this requires strong engagement with Engineering, Planning and Wastewater. Difficulty: 8 **Average difficulty rating: 6**				
Showcase water conservation	Residential	Install educational signs and displays at City buildings, including	Staffing: require one dedicated staff member to	Staffing: a full-time, permanent	Assuming the education and outreach result in a	Market value: 17,527 m^3/year ×	Payback period: $7,020/year ÷ $13,145/year = 6

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operations at City facilities		Recreation facilities, that showcase The City's leadership in water conservation work (Low Impact Development, water recycling and re-use, rainwater harvesting, etc). This could extend to open houses and tours of City facilities, to be continued throughout the 2019 Winter Games.	oversee the development and implementation of water conservation programs, including showcasing water conservation operations. This would require collaboration with facilities staff. Difficulty: 8 <u>Materials:</u> none. Difficulty: 1 <u>Time frame:</u> 1-2 years for planning	staff will require an annual salary: $36/hour + 25.50% burden = $88,101 ÷ 10 projects = $8,810/year. <u>Signs, displays, installations:</u> up to $10,000. Total: $10,000 in capital costs, plus $7,020/year. **Cost rating: 2**	0.25% reduction in annual residential water consumption (7,010,985 m^3 in 2014) = water saving may be 17,527 m^3/year. Total: 17,527 m^3/year. **Water savings rating: 5**	$0.75/$m^3$ = $13,145/year saved by The City and the residential sector.	months.

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			and development, continual implementation (no time period). Difficulty: 3 <u>Barriers:</u> Will not see direct water savings. Difficulty: 7 **Average difficulty rating: 5.35**				
Incorporate sustainability topics in Recreation programs for children and	Residential	Introduce concepts about water conservation, energy conservation, waste diversion and other sustainability topics to children and youth	<u>Staffing:</u> require one dedicated staff member to oversee the development and implementation of	<u>Staffing:</u> a full-time, permanent staff will require an annual salary:	Assuming that each participant reduces their annual per capita consumption of 195 lpcd by 2% = 4	Market value: 0.8 m^3/year × $0.75/$m^3$ = $0.60/year saved by	Payback period: $7,020/year ÷ $0.60/year = 11,700 years.

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youth		programs offered by Recreation.	water conservation programs, including showcasing water conservation operations. This would require collaboration with Recreation staff. Difficulty: 7 Materials: none. Difficulty: 1 Time frame: 1-2 years for planning and development, continual implementation	$36/hour + 25.50% burden = $88,101 ÷ 10 projects = $8,810/year. Total: $7,020/year. **Cost rating: 1**	L/year × 200 participants = 800 L/year. Total: 0.8 m^3/year. **Water savings rating: 1**	The City and the residential sector.	

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			(no time period). Difficulty: 7 <u>Barriers:</u> Will not see direct water savings. Difficulty: 7 **Average difficulty rating: 6.4**				
Explore the feasibility of offering tours of the WTP and WWTP.	Residential	Explore the logistics of offering tours and/or virtual tours of the WTP and WWTP for members of the public, including school groups.	<u>Staffing:</u> require one dedicated staff member to oversee the development and implementation of water conservation programs, including	<u>Staffing:</u> a full-time, permanent staff will require an annual salary: $36/hour + 25.50% burden = $88,101 ÷ 10 projects =	Assuming each plant conducts 2 tours per month, 30 people per tour, and assuming that each person on the tour reduces their consumption by per capita consumption by	Market value: 14 m^3/year × $0.75/$m^3$ = $10.50/year saved by The City and the residential sector.	Payback period: $20,700/year ÷ $10.50/year = 1,972 years.

Initiative	**Target Sector** Residential ICI City Regional	**Description**	**Difficulty** **1-3** = no staff required, materials are easy to access, develop or install, 0-2 year time frame, few barriers **4-6** = Part-time/overtime staff required, materials may be more challenging to access, develop or install, 3-5 year time frame, some barriers **7-10** = Full-time staff required, materials are challenging to access, develop or install, 5+ year time frame, large barriers	**Cost** **1-3** = 0-\$50,000/year **4-6** = \$50,000/year-\$100,000/year **7-10** = \$100,000/year+	**Water Savings** **1-3** = 0-10,000 m^3/year **4-6** = 10,000m^3/year – 20,000 m^3/year **7-10** = 20,000 m^3/year+	**Market Value/Dollar Cost of Water Savings** Water Savings × \$0.75/m^3	**Payback Period** Cost ÷ Market Value
			showcasing water conservation operations. Water/Wastewater staff may also need to work overtime hours to conduct tours (on top of their regular work). Difficulty: 9 <u>Materials:</u> informational material/brochures to give out to those who go on tours. Difficulty: 4	\$8,810/year. Overtime for 1 Water and 1 Wastewater staff: \$80/hours × 5 hours/tour × 24 tours/year × 2 staff = \$19,200/year. <u>Informational materials:</u> \$1,500/year. Total: up to \$20,700/year. **Cost rating: 2**	10% = 2 × 30 × 12 = 720 people × 195 lpcd × 0.1 = 14 m^3/year. Total: 14 m^3/year. **Water savings rating: 1**		

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			<u>Time frame:</u> 1 year of planning and development, continual implementation (no time period). Difficulty: 7 <u>Barriers:</u> Staff capacity is major barrier, as well as security and safety hazards in the treatment plants. Difficulty: 9 **Average difficulty rating: 7.8**				
Re-design the	Residential,	Design a comprehensive	<u>Staffing:</u> require	<u>Staffing:</u> a full-	2014 website	Market	Payback period:

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City water website as an interactive resource	ICI, City, regional	and interactive website that educates and informs residents about The City's water conservation initiatives, tips and guides to conserving water at home.	one dedicated staff member to oversee the development and implementation of water conservation programs, the website re-design. May also need to hire a website designer if Communications is not capable of designing certain elements in-house. Will also need capacity and support from Communications.	time, permanent staff will require an annual salary: \$36/hour + 25.50% burden = \$88,101 ÷ 10 projects = \$8,810/year. <u>Website designer:</u> \$500-\$5,000. Total: \$10,020/year. **Cost rating: 1**	analytics show that the Environmental Services webpages received 22,373 unique page views. Assuming that each of these readers reduces their per capita water consumption (195 lpcd in 2014) by 2%, water savings may be 87 m^3/year. Total: 87 m^3/year. **Water savings rating: 1**	value: 87 m^3/year × \$0.75/m^3 = \$65.25/year saved by The City and the residential sector.	\$10,020/year ÷ \$65.25/year = 154 years.

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			Difficulty: 9 <ins>Materials:</ins> none. Difficulty: 1 <ins>Time frame:</ins> 1 year for development and implementation. Difficulty: 2 <ins>Barriers:</ins> Some people may not have access to computers or the internet, so equal effort needs to be made to ensure that critical information is				

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			distributed through print-outs. Difficulty: 7 **Average difficulty rating: 5.35**